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DEPARTMENT OF AGRICULTURE.

MISCELLANEOUS. SPECIAL REPORT No. 8.

COTTON

IN THE

EMPIRE OF BRAZIL;

THE ANTIQUITY, METHODS AND EXTENT OF ITS CULTIVATION; TOGETHER WITH
STATISTICS OF EXPORTATION AND HOME CONSUMPTION.

BY

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[REPORT MADE TO PROF. C. V. RILEY, U. S. ENTOMOLOGIST.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.

1885.

14807—No. 8

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DEPARTMENT OF AGRICULTURE,

Washington, D. C., April 24, 1885. 7

SIR : During the winter of 1883-'84, Mr. J. C. Branner, assisted by Mr. A. Koebele, was sent to Brazil to collect certain entomological information, and, incidentally, any facts relating to cotton and its culture. A preliminary account of the journey has been published in Bulletin No. 4 of the Division of Entomology, and the entomological observations have been, or will be, used elsewhere. The report herewith submitted contains much of interest to our people, and shows what good use Mr. Branner made of his time. I would therefore recommend its publication as one of the Miscellaneous Special Reports of the Department.

Respectfully,

C. V. RILEY,

Entomologist.

Hon. NORMAN J. COLMAN,

Commissioner of Agriculture.

P R E F A C E .

Cotton in Brazil grows on its native soil, and, it is to be presumed, under climatic and other conditions best adapted to its highest development. But though Brazil began to export cotton more than a hundred years before the United States, her annual product to-day is only about one-eighteenth as much as our own. To be sure, the population is only one-fifth as large as ours, but then almost the whole population lives in a cotton-growing region, while only a small part of our people live in the cotton belt.

Under normal conditions Brazil can scarcely become a competitor of the United States in cotton production. But the disappearance of slavery, and the consequent adoption of some system of small farming, will, in the near future, materially increase the present production. Slavery has fostered a remarkable conservatism in agriculture, which must, with the aid of educated planters, soon disappear. Cotton factories are already rapidly springing up and prospering, and the day is not far distant when they will supply the Brazilian market.

The same agricultural tools and methods now employed by the average planters were in use more than two hundred years ago—methods learned from their Portuguese ancestors and from their slaves. It is far from my intention, however, to criticise these methods or the men who use them. The climate in which they live and the circumstances which have produced and retained these methods are so entirely different from our climate and our surroundings that any criticism from our standpoint would almost necessarily be unjust. But may we not reasonably ask whether Brazilian planters have tested fairly what are generally recognized in other countries as improvements, both in machinery and in methods? The lack of capital and lack of common roads are serious matters, no doubt, but they are not insuperable difficulties. Insect plagues that destroy from a fourth to a half of their crops are great drawbacks, but such questions should be regarded, not as visitations of God, before which man is powerless, but as practical matters to be met and dealt with as our planters, guided by our distinguished entomologist, have met and dealt with similar plagues in this country.

This part of the report is, of course, merely incidental to the main objects of my trip. It includes not only the notes made during the time I was commissioned as special agent of the Department of Agriculture, but also observations extending over a period of eight years, during which I traveled in almost every province of the Brazilian Empire.

To Professor Riley I am indebted for many valuable suggestions, and whatever there may be of entomological value in this or other parts of the report must be credited to him.

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COTTON IN THE EMPIRE OF BRAZIL.

HISTORICAL.

Several writers upon Brazil state that cotton is indigenous to that country, but none of them, as far as I am able to learn, with the exception of Auguste de Saint-Hilaire, mentions his authority for such a statement.

Denis, whose History of Brazil is one of the most trustworthy, says:¹

The cotton plant is indigenous to Brazil, and it is probable that without making of it a particular object of cultivation, the Indians used it as they did divers other textile plants, to make hammocks. * * *

Pereira da Silva, in his History of the foundation of the Brazilian Empire, says² that cotton was one of the indigenous plants of Brazil which began to be cultivated soon after the discovery of the country, owing to the knowledge of it that already existed in Europe, and the use there made of it.

Beauchamp, in his History of Brazil, treating of the period immediately following its discovery, that is, from 1500 to 1521, refers to the cotton cords used by the Indians upon their bows, and for other purposes.³

The well-known Brazilian author, the Visconde de Porto Seguro (Varnhagem), in his General History of Brazil, says⁴ that the cotton plant is indigenous to Brazil. In another place,⁵ describing the customs and utensils of the ancient inhabitants of the Upper Amazonas, he says that they made use of blow-guns, the arrows for which were wrapped about with cotton.

Auguste de Saint-Hilaire, one of the most trustworthy authorities and careful observers of all those who have traveled in Brazil, says that the oldest travelers found cotton in use among the Indians along the Brazilian coast, and that they used it for making cords, hammocks,

¹ *L'Univers, ou Histoire et Description de tous les peuples: Brésil*, par M. Ferdinand Denis, p. 67.

² *Historiã da Fundição do Imperio Brasileiro*, por J. M. Pereira da Silva, vol. I, p. 253-4.

³ *Histoire du Brésil depuis sa découverte en 1500 jusqu'en 1810*, par M. Alphonse de Beauchamp, vol. I, pp. 93, 96. This history by Beauchamp is a *résumé* of the *History of Brazil* by Robert Southey.

⁴ *Historia Geral do Brazil*, pelo Visconde de Porto Seguro, 2d ed., vol. I, p. 9.

⁵ *Loc. cit.*, p. 30.

and even clothing. As his authority, he cites Hans Stade, a German gunner who was held in captivity by the Indians of southeastern Brazil from 1547 to 1555.¹

Joaquim de Almeida Pinto, in his Botanical Dictionary of Brazil, says² that cotton is indigenous to Brazil, and that previous to the conquest of that country by the Portuguese, presents were sent thence to the king of Spain, among which were various articles made of cotton.

Abundant evidence of the fact that cotton was used by the Indians at the time of the discovery is furnished by the oldest documents upon Brazil referring to that event, and by letters of the Jesuit missionaries, who immediately undertook to christianize the Indians.

The existence among the aborigines of words signifying cotton would, of itself, point to their knowledge of cotton, and very probably to some of its uses,³ for it is hardly to be supposed that savages, whose vocabularies are, as a rule, limited, would have a name for a plant for which they knew no use. Such words are given by several writers upon the Indians inhabiting Brazil.

Gabriel Soares de Souza, who lived in the province of Bahia from 1570 to 1587, says⁴ the Indian name for cotton is *maniim*. Varnhagem says⁵ the name is *manyú*, and gives other words more or less resembling this as quoted by other authorities, such as *amanyú*⁶ and *amandiyú*.⁷ Claude d'Abbeville, a French missionary, who was in Maranhão from 1612 to 1614, gives *amongiom*.⁸ The Bugres, inhabitants of southern Brazil, called it *yxomtom*.⁹ The Cayuás called it *amany ri*.¹⁰ The Tupis said *amaníú*, or *amanijú*, while cotton thread was called *inimu amaniu xitúára*, or *amaniú inimú*.¹¹ The Mundurucú Indians of the Tapajos region on the Amazonas call cotton *bruun-á*.¹² In the Língua Geral of the Upper Amazonas cotton is *amanihú*.¹³ The Ticuna tribe of the

¹ *Voyage dans le District des Diamans*, par Auguste de Saint-Hilaire, Paris, 1833, vol. II, pp. 253-254, foot-note. The story of Hans Stade was originally written in German, and subsequently translated into French, English, Flemish, Dutch, and Latin. The English edition, published by the Hakluyt Society, is called *The Captivity of Hans Stade of Hesse*, translated by Albert Tootal and annotated by Capt. R. F. Burton, London, 1874.

² *Diccionario de Botanica Brasileira*, por Joaquim de Almeida Pinto, Rio de Janeiro, 1873, p. 21, under "Algodão."

³ *Revista do Instituto Historico do Brazil*, 1851, p. 202. Gabriel Soares de Souza says the Indians used the green bolls for food by crushing and making of them a kind of porridge.

⁴ *Loc. cit.*, p. 201.

⁵ *Revista do Instituto Historico do Brazil*, 1851, p. 392.

⁶ *Diccionario Brasileiro*, Lisbon, 1795.

⁷ *Arte de la lengua Guarani*, por Antonio Ruiz de Montoya, p. 151.

⁸ Folio 226, V. Probably a Tupinambá word.

⁹ *Revista do Instituto Historico do Brazil*, 1852, p. 61.

¹⁰ *Op. cit.*, an. 1856, p. 450.

¹¹ *O Selvagem*, by Couto de Magalhães, p. 20.

¹² *Revista do Instituto Historico do Brazil*, 1877, pt. II, p. 119.

¹³ Gonçalves Dias in *Revista do Inst. Hist. Braz.*, 1854, p. 555.

Upper Amazonas call it *tech*.¹ The Botocúdu, living between Rio de Janeiro and Bahia, call it *angnovang*.²

Now all these words, except those of the Mundurucús and Ticunas of the Amazon region, and those of the Botocúdu and Bugres of southern Brazil, appear to be the same, or, at least, to have the same origin. The slight differences that exist in most cases may be genuine and caused by differences in the languages as spoken by various tribes or sub-tribes belonging to some one great nation that formerly inhabited the greater part of what is now Brazil, or these differences may be attributable to differences among observers, and, in some cases, to differences in the nationalities of the observers. It should be remarked also that none of these words bear any resemblance to the Portuguese word for cotton, *algodão*, or to the Spanish, *algodon*, unless it be the one used by the Bugres, *ycomtom*.

Let us now consider the documentary evidence of the use of cotton by the aborigines of Brazil at the time of the discovery.

In a letter written to the king by Pero Vaz de Caminha, a companion of Cabral when he first landed on the Brazilian coast, and dated at Porto Seguro, May 1, 1500, the author refers to hammocks in which the Indians slept,³ and to cloth used by the women.⁴ It is true that these hammocks and this cloth may have been of some other material than cotton; but during the years immediately following, several allusions are made to the hammocks and cloth of the Indians, which are stated to be of cotton. Of course no earlier documentary evidence than this can be had.

On a voyage to the River Plate country, Diego Garcia touched at Pernambuco in 1526. One of his companions, Luiz Ramirez, in a letter dated from the Rio de la Plata, then known as the Rio de Solis, July 10, 1528, gives a detailed description of their stopping at Pernambuco, and at Santa Catherina, on the coast of Brazil, and of what they there saw of the natives.

Speaking of the Indians at Pernambuco he says:⁵

The Indians of this country are called Tupisnabo.⁶ * * * Their mode of sleeping is in a net which they call *amaca*, which is the length of a man, and wide enough to turn over and cover the body. They hang them in the air. * * * They are made of cotton thread, of which there is plenty in this country⁷. I do not add any other details because it would be tiresome, except that men and women all go about naked without any covering.

¹ Paul Marcoy, vol. II, p. 323.

² Prince Maximilien Wied-Neuwied, *Voyage au Brésil*, vol. III, p. 315.

³ *Corografia Brasilica*, por Manoel Ayres de Casal, vol. I, p. 27. "Tinham dentro muytos esteos, e destes a esteo huuma rede atada pelos cabos a cada esteo, altas, em que dormiam."

⁴ *Corografia Brasilica*, Casal, vol. I, p. 24. "Tam beem andava hy outra mulher mosa com menino * * * no colo, atado com hum pano, nom sey de que ahos peytos."

⁵ This letter of Ramirez, written in Spanish, is in the library of the Escorial in Spain. It was copied there by Varnhagem, the historian, and printed in 1852 in the *Revista do Instituto Historico do Brazil*, q. v., p. 14 *et seq.*

⁶ Tupinambás.

⁷ Son de hilo de algodon que en esta tierra hai mucho. (*Loc. cit.*, p. 18.)

On the 28th of October, 1526, this squadron reached the Island of Santa Catherina,¹ where it remained until February 15, 1527. In speaking of this place Ramirez says:²

The fruits of this country are few and far between; the food is the same as that of Pernambuco, and the people are of the same kind and condition, except that the married women wear little cotton petticoats, so that they do not go about as indecently as those I have mentioned above.

A priest of the company of Jesus, Father Manuel da Nobrega, who came to Brazil in 1549³ as a missionary among the Indians, often refers to the cotton used by them. In a letter written to another Jesuit in Portugal, and dated from Bahia, August 9, 1549, he says there is much cotton there.⁴ In another letter, which bears no other date than the "Land of Brazil,"⁵ this same priest says that "the people go naked, except in some places a long way from here, where the women dress in cotton cloth, because there it is colder than it is here."⁶ This reference must be to the more southern part of Brazil, possibly to Santa Catherina, where Ramirez saw the women dressed in cotton cloth. In this letter Father Nobrega says the Indians "sleep in hammocks made of cotton."⁷ Again in a letter written from Olinda, province of Pernambuco, September 17, 1551, Father Nobrega refers to the fertility of the soil, and says that they (the society) could feed and clothe a great many children if they only had a few slaves to plant cotton and provisions.⁸

Gabriel Soares de Souza, who lived in what is now the province of Bahia from 1570 to about 1587, describes in detail some of the Indians then inhabiting that part of Brazil, and whom he calls *Tapuias*.⁹

¹ "Puerto de la Santa Catalina." (*Loc. cit.*, p. 23.)

² *Revista do Instituto Historico do Brazil*, 1852, p. 23.

³ *Revista do Instituto Historico do Brazil*, 1843, p. 429. He says that he arrived at Bahia March 29, 1549.

⁴ "E para se vestir farão um algodoal, que cá ha muito." *Revista do Instituto Historico do Brazil*, 1843, p. 439.

⁵ This letter was probably written either from Pernambuco or Bahia in 1549, for there are other letters from him dated from both these places in that same year. (See *Revista do Instituto Historico do Brazil*, 1844, p. 106, and *op. cit.*, 1843, p. 429.)

⁶ "As mulheres andam vestidas com pannos de algodão. (*Revista do Instituto Historico do Brazil*, 1844, p. 91.)

⁷ *Revista do Instituto Historico do Brazil*, 1844, p. 92. "Dormem em redes de algodão."

⁸ *Revista do Instituto Historico do Brazil*, 1840, p. 282.

⁹ *Tapuia*, *tapuya*, or *tapuyo* does not mean any particular tribe, but is the name applied to any of the wild tribes of Indians. The civilized Indians are called *Índios mansos*. (See also *Voyage au Brésil*, par S. A. S. Maximilien, Prince de Wied-Neuwied, vol. I, p. xiii.) Varnhagem, in his comments upon the *Roteiro do Brazil* by Gabriel Soares de Souza, says (*Revist. Inst. Hist. Braz.*, 1851, p. 406) that there was no such nation in Brazil as the *Tapuias*, but that this word was applied by one race to another, and especially by the more to the less civilized, just as the Indians of the Amazonas are now called *Tapuios*. This, however, would not affect the statement of de Souza, who may have been misled, as so many others have been, merely in regard to the name of the tribe of Indians he was speaking of.

It is the custom of the males [says he¹] to wear their hair so long that it reaches their waist, and sometimes they have it braided and intertwined with strips of cotton so that it looks like a very broad braid. The women are close shaven, and wear about themselves aprons made of cotton thread, with a long fringe.²

In a description of Brazil and its captaincies, written in 1584, probably by a Jesuit missionary, the author says³ that the Indians, for the most part, go naked, but that some of them, on account of their country being colder, use skins of deer and of other animals, and that some of the women make coarse cotton cloth, with which they cover half of their bodies.

Claude d'Abbeville, a Capuchin missionary to the Indians of Maranhão in 1612-'14, says⁴ that the natives of that part of the country had cotton hammocks. In another place he says⁵ that—

They gather and clean, beat and spin cotton with much dexterity, and with it make open hammocks resembling nets, and others as well woven and full of figures as if they were the work of better weavers; also aprons, in which they carry their children about their necks.

Ivo d'Evreux, another Capuchin missionary in Maranhão at the same time, speaks of the natives making use of cotton in their jugglery.⁶

But while these evidences seem sufficient to show that cotton was known to the Indians at the time of and previous to the discovery of Brazil, there is nothing to indicate that it was cultivated by them with any care or to any considerable extent. The picture of the indifference of the aborigines in regard to such matters is vividly suggested by the manner in which a few straggling plants are allowed to grow about their houses even nowadays by the civilized Indians and by the poor classes generally through the interior of the country.

Gabriel Soares de Souza says⁷ that it was not the custom of the *Tapuias*⁸ to plant anything except corn and other such vegetables.

Gonçalves Dias, speaking of the *Tapuyas*,⁸ says they were not agriculturists,⁹ but that they lived almost exclusively upon game, or, in the intervals between their expeditions, planted fields of corn so insignificant that, as they still do, in a single day they ate up the whole year's crop.

¹ *Revista do Instituto Historico do Brazil*, 1851, p. 352.

² *Revista do Instituto Historico do Brazil*, 1851, p. 352. "Trazem cingidas de redor de si umas franjas de fio de algodão que tem os cadilhos tão compridos que bastam para lhe cobrirem suas vergonhas."

³ *Revista do Instituto Historico do Brazil*, vol. VI, p. 438. This description is intended to cover the period of Brazilian history up to about 1584. It was found and copied in Lisbon by Varnhagem.

⁴ *Histoire de la Mission des Pères Capucins en l'Isle de Maragnan*, Paris, 1614. Portuguese ed., p. 328.

⁵ *Historia do Maranhão*, Claude d'Abbeville, p. 356.

⁶ *Historia da Missão dos Padres Capuchinos na Ilha do Maranhão*, por Ivo d'Evreux. Portuguese ed., p. 123.

⁷ *Revista do Instituto Historico do Brazil*, 1851, p. 352.

⁸ See foot-note ³ on previous page.

⁹ *Revista do Instituto Historico do Brazil*, vol. XXX, part 2, pp. 64-65.

Prince Maximilien, speaking of the Indians in the interior of Bahia, in 1817, says: ¹ "Ils récoltent aussi une petite quantité de coton."

Much evidence might be brought to show that from the nature of the Indians it is not to be expected that they cultivated cotton to any considerable extent. There are but few of them, even among the civilized Indians of to-day, that look beyond the immediate necessities of the hour.²

As soon, however, as the Portuguese established themselves in Brazil, cotton culture was taken up by them, both for domestic use and for exportation to the Peninsula. The letters of Father Nobrega, already cited, show that the Portuguese were cultivating or anticipated cultivating cotton even as early as 1549, both in Bahia and in Pernambuco.

Pedro de Magalhães Gandavo, who lived in Brazil for several years previous to 1570, wrote a history of the country up to that time, in which, speaking of the useful plants there, he says: ³

There are still others which are the principal articles produced by the inhabitants, namely, much sugar cane and cotton, with which every one supports himself, and which is turned to great account in each one of the captaincies, especially in Pernambuco, where there are about thirty sugar mills, and in Bahia do Salvador almost as many more, where a great quantity of sugar is made every year, and a great amount of cotton⁴ obtained, a great deal more than in any of the others.

From 1570 to 1587 Gabriel Soares de Souza wrote⁵ of the cotton plant in Bahia:

These cotton plants are cleaned with the hoe two or three times during the year to keep the weeds from choking them.

The writer of this *Roteiro do Brazil* was himself a Portuguese planter, and, of course, the use of the hoe was as unknown to the Indians as it was familiar to the Portuguese.

In 1612 Claude d'Abbeville, stopping on the island of Fernando de Noronha⁶ on his way to Maranhão, says that he found "much corn and cotton" growing there. At that time the island was inhabited by only one Portuguese and sixteen or eighteen Indian slaves, who had been sent there from Pernambuco.⁷

In 1614 Diogo de Campos Moreno made a trip to Maranhão by order

¹ *Voyage au Brésil*, par S. A. S. Maximilien, vol. III, pp. 160-161. In vol. I, p. 229, he refers to cotton thread made by the women of another tribe.

² My own experience with the Indians of Brazil is that they cannot be depended upon to make any provision for future emergencies, even of the simplest and most necessary kind. I never could get one to hunt or fish in earnest as long as there was any food in the house.

³ *Historia da Provincia São Cruz a que vulgarmête chamamos Brasil*, feita por Pero de Magalhães Gandavo. Lisbon, 1576. Reprinted in the *Revista do Instituto Historico do Brazil*, 1858.

⁴ "—e se dá infinito algodam." *Op. cit.*, p. 392.

⁵ *O Roteiro do Brazil*, por Gabriel Soares de Souza, reprinted in the *Revista do Instituto Historico do Brazil*, 1851, p. 202.

⁶ *Historia do Maranhão*, por Claude d'Abbeville, Portuguese ed., p. 50.

⁷ Claude d'Abbeville, Portuguese ed., p. 52. Abbeville says that when the ship on which he was a passenger left Fernando it carried away all these people to Maranhão.

of the king of Portugal, and, in regard to cotton, said that the French were cultivating it there to some advantage.¹

In 1639 a Jesuit priest, Christovam d'Acuña, by the order of the king of Spain, descended the Amazonas from Peru. His description of the voyage, the river, and objects observed was published in Madrid in 1641. After recapitulating the products of the valley of the Amazonas, he says:

But there are also many others which, although of less value, could not fail to increase the royal treasury, namely: cotton, which is gathered here in abundance.

Notwithstanding all these evidences of the general cultivation of cotton throughout Brazil, there is, up to this time, no evidence of its having been exported generally, or to any great extent, and, indeed, but little evidence of its being exported at all.

THE BEGINNING OF EXPORTATION.

Authorities do not agree in regard to the year in which cotton was first exported from Brazil.

Dr. Cezar Augusto Marques, in his Dictionary of the Province of Maranhão, says² that after the formation of the commercial company of Maranhão and Gram-Pará the first exportation of cotton took place in 1760, which consisted of 651 arrobas, or 20,832 pounds.

In a memorial upon the cultivation of cotton, published in Lisbon in 1749, Dr. Manoel Arruda da Camara says³ that cotton was first sent from Pernambuco to Portugal in 1778, but that up to 1781 the quantity shipped was very small.

Mr. J. B. Lyman,⁴ in his *Cotton Culture*, says that the export of cotton from Brazil to England began in 1781.

The Parliamentary Commission of Inquiry of 1882,⁵ in its report to the Government, says that cotton was exported from Brazil to Europe in the latter half of the eighteenth century, long before a single bale had left the United States.

A commission appointed by the Government in 1852 to revise the tariffs have the following in their report⁶ regarding the early exportation of cotton, and which, it will be remarked, appears to have been taken from the work of Dr. Arruda da Camara just referred to:

In some parts of Brazil in remote times there was no exportation of cotton, the cultivation of which was limited to what was necessary for use in the country. * * * It was from Parahyba that it was first exported, whence it was sent to Portugal. Pernambuco was given up for a long time to the production of sugar, and it was only in 1778 that it exported this article for the first time. Its exportation, however, was very small until 1781.

¹ *Jornada do Maranhão por ordem de S. Majestade, feito no anno de 1614, por Diogo de Campos Moreno.*

² *Diccionario Historico-Geographico da Provincia do Maranhão*, p. 13.

³ *Memoria sobre a Cultura dos Algodoeiros*, por Dr. Manoel Arruda da Camara, chap. I.

⁴ *Cotton Culture*, by J. B. Lyman, p. 153.

⁵ *Auxiliador da Industria Nacional*, January, 1883, p. 5.

⁶ *Relatorio da Commissão da Revisão da Tarifa apresentado ao Governo Imperial*, Rio de Janeiro, 1853.

In view of the limited demand for the raw material in Europe, it cannot be expected that the exportations of those days could compare with those of a hundred years later; but it must have been exported in what were, for those times, considerable quantities many years before the dates referred to by the above-cited authorities.

Some very interesting facts bearing upon this subject are incidentally given in the story of the shipwreck of Jorge de Albuquerque Coelho.¹ This man accompanied his brother, Duarte Albuquerque Coelho, who was the heir to the captaincy of Pernambuco, to that place from Lisbon, in the year 1560. He was appointed by his brother chief officer of the military forces, and during the five years following he made war upon the Indians in the vicinity of Pernambuco. The writer of the story, Bento Teixeira Pinto, a native of Pernambuco, and who was also in this shipwreck, says that when Jorge de Albuquerque Coelho took charge of the forces "the Portuguese living in Olinda did not dare go farther than two or three leagues inland and three or four leagues along the coast," and that after he had conquered the Indians "they could safely go fifteen or twenty leagues inland and seventy along the coast."²

On the 16th of May, 1565, the writer of the story and Jorge de Albuquerque Coelho embarked for Portugal on a ship *loaded in the port of Olinda*, that is, at Pernambuco. On account of the condition of the vessel, they put back to Olinda, and left again on the 29th of June, 1565. Their passage was a stormy one, and the sea became so rough at one time that they were obliged to throw part of their cargo overboard. I quote:

And seeing that all this was of no avail, and that the waves grew the higher, as if they wished to overwhelm us, we threw overboard the artillery and many boxes of sugar and *many bales of cotton*.³

Now, as this vessel had been loaded in the port of Olinda, in the province of Pernambuco, and as Jorge de Albuquerque Coelho had opened up the country since his arrival, so that the Portuguese could go as far as twenty leagues inland, these "many boxes of sugar and many bales of cotton" must have been grown by the Portuguese within this area.⁴

THE EARLY USES.

After the settlement of Brazil by the Portuguese, slavery at once became a prominent factor in the development of the agricultural resources of the country, and the sugar and cotton that were exported to the

¹*Revista do Instituto Historico do Brazil*, 1850, p. 279, *et seq.*

²*Loc. cit.*, 1850, p. 281.

³*Loc. cit.*, 1850, p. 289.

⁴It is interesting to note that no cotton at all is now grown in the area referred to. Koster, writing of the period between 1809 and 1815, says: "The cotton plantations are yearly receding farther into the interior, wherever the sertam plains do not prevent this recession. The plantations of this description, which were formerly established nearer to the coast, are now employed in the rearing of other plants." (*Travels in Brazil*, by Henry Koster, vol. II, p. 169.)

Peninsula were doubtless produced by slave labor. But cotton was probably more extensively used for a circulating medium and for domestic purposes than for exportation in those days.

In 1670 the attorneys of the people of Maranhão represented to the chambers that—

It was the greatest injury to the people to allow cotton cloth to go out of the city, because, inasmuch as it was money,¹ it should not leave that country for some other, and that unless its exportation was prohibited not a yard of cloth—or rather no money—would be found in Maranhão.²

At that time there was a great trade in this article with the neighboring captaincies, especially with Minas Geraes and Goyaz, “and the people generally, even the senators, were accustomed to dress in clothing made of cotton.”³ Accordingly, in 1699, exportation of cotton from Maranhão was prohibited, and in 1703 prohibition extended both to cleaned cotton and to cotton with the seed.

In 1686 action was taken in regard to the fraud found to be practiced with balls of cotton thread,⁴ which circulated for money,⁵ and in which pieces of cloth, rags, and other things were found.⁶

In the representations of the ministers of the people to the chambers of Maranhão, made in 1701, it was urged that—

The greater part of the cotton was exported, while the little that remained was scarcely sufficient to supply the wants of the place; for, aside from the inhabitants generally wearing cotton, it also served instead of currency, without which commerce became paralyzed; adding, moreover, that there was no work for the poor people and for slaves whose occupation it was to spin and weave.

In other parts of Brazil also cotton was used instead of money. In Pará this was the case, a large part of the cotton that went from Maranhão, while yet it was allowed to be exported, going to that place. Indeed, it was only after 1747 that gold, silver, and copper came into general use there, the circulating medium up to that time “having consisted of balls of cotton and articles of domestic goods.”⁷

¹ Arruda da Camara says of cotton in Maranhão, that it was “only cultivated for use in the country, which was so poor that cotton thread made by the people was the money of the province and used to buy whatever was wanted. Even in the butcher shops meat was bought with balls of thread.” (*Memoria sobre a Cultura dos Algodoeiros*, por Dr. Manoel Arruda da Camara, chap. I.)

² *Auxiliador da Industria Nacional*, 1866, p. 116; and Dr. C. A. Marques, *Diccionario do Maranhão*, p. 12.

³ *Loc. cit.*

⁴ It may be interesting to know that a ball of cotton thread was then worth from 20 to 25 reals (2 to 2½ cents) in Maranhão, and a roll of cloth was worth \$10. The size of the balls and length of the cloth are not stated. (*Auxiliador da Industria Nacional*, 1866, p. 116.)

⁵ The Government's committee for revising the tariff, in their *Relatorio apresentado ao Governo Imperial*, and printed in 1853 in Rio de Janeiro, states that “in Maranhão the cotton thread made by the inhabitants was the currency of the province, and used by them in supplying their wants.”

⁶ Dr. C. A. Marques, *Diccionario do Maranhão*, p. 13.

⁷ *Sketches of Residence and Travels in Brazil*, by Rev. Daniel P. Kidder, Philadelphia, 1845, vol. II, p. 313.

It was not until 1756 that the law prohibiting the exportation of cotton from Maranhão was repealed,¹ and as cotton could not be used for other than domestic purposes and as a circulating medium, it is very possible that up to this date there was very little development of this branch of agriculture in the part of the country affected by this prohibition. In this case the prohibition only affected the exportation of cotton from the province of Maranhão; but it is to be remembered that at this time, and, indeed, up to 1811, what is now the province of Piauhý formed part of the province of Maranhão.²

Before the end of the seventeenth century the cultivation of cotton had already become general throughout almost the whole of Brazil, and considerable quantities had been exported to Europe. During the eighteenth century the more general use of gold as a circulating medium,³ the removal of prohibitory laws, and the increasing demand for the raw material in Europe, led to what was, for those times, an extensive cultivation and exportation.

The Amazon region seems to have attracted attention as a possibly great cotton producing country. Bishop João de S. José, paying a visit to the interior of his bishopric of Gram-Pará, along the Amazonas, in 1762-'63, refers on several occasions to the abundance of the cotton grown by the people. At Villaboim, on the Lower Tapajós, he saw a great many cotton plants. At Pinhel, four hours' journey up the river, he again remarks on the abundance of cotton, and adds that if there were a factory at Pará cotton would become a great branch of commerce.⁴

Making a voyage of inspection through the Amazon Valley in 1784, Martinho de Souza e Albuquerque, then governor and captain-general of Brazil, found at Macapá, the principal city on the northern side of the Amazon, near its mouth, that the principal articles planted were rice and cotton.⁵ At Mazagão, a little farther up the river, on the northern side, he found that the land was well adapted to cotton raising, and that the inhabitants had done well in cultivating this article.⁶

A Jesuit missionary, João Daniel, when visiting the Spanish missions

¹ The *Auxiliador da Industria Nacional*, 1866, p. 116, says that this prohibition was removed in 1757, but Dr. Marques says it was removed January 16, 1756. (See *Diccionario do Maranhão*, p. 13.)

² Dr. C. A. Marques, *Diccionario do Maranhão*, p. 371.

³ Balls of cotton thread were probably used for a long time afterwards in place of money, especially in parts of the country far removed from the commercial centers. A Benedictine monk traveling on the Amazonas in 1762-'63, speaks as follows of Villaboim on the Rio Tapajós: "O trabalho aqui é fazer a roça das farinhas, e fiar algodão de que ha muitas arvores no estado, e os novellos d'este eram a moeda usual algum tempo."—*Revista do Instituto Historico do Brazil*, 1847, p. 181. The inhabitants of this village were Indians. (See the *Corografia Brasilica* of Casal.)

⁴ *Revista do Instituto Historico do Brazil*, 1847, pt. I, p. 191.

⁵ "Responderam ser o arroz e o algodão os que melhor pagavam os seus trabalhos, e sobre que elles fundamentavam seus interesses." (*Revist. Inst. Hist. Braz.*, 1849, p. 305.)

⁶ *Revist. Inst. Hist. Braz.*, 1849, p. 308.

west of the Madeira River, in 1797, says that the Indians there "learn various trades and manufacture very fine and valuable cotton cloths."¹

The domestic consumption of cotton must have been very large up to the end of the eighteenth century, owing to its general use for clothing, even by the people of consideration, in some parts of the country at least.²

The manufacture of cotton cloth was carried on to such an extent that in 1784 complaint was made to the king of Portugal by the Portuguese merchants that it was interfering with their legitimate business and with the income of the royal treasury. Private instructions³ were therefore given, January 5, 1785,⁴ to the officers and agents of the Crown in Rio de Janeiro to extinguish all factories of silk, linen, cotton and woolen goods, and, if it should become necessary, to confiscate the looms. A single and important exception was made.

The twentieth article of the decree is as follows:⁵

In view, however, of the great number of slaves, Indians and poor families throughout all the captaincies of Brazil, and the great inconvenience that it would cause them if they were obliged to wear clothing even of the poorest quality sent from Europe, His Majesty orders excepted from the aforesaid general prohibition factories and looms for making coarse cotton cloth such as is generally used by the said negroes, Indians and poor families, and for baling and packing goods, and for such other uses.

In accordance with these instructions, all weaving, except that of the coarsest kinds of cotton cloths, was suppressed. An official document addressed by the authorities in Rio de Janeiro to the Minister of the Crown in Lisbon in July, 1788, gives a list⁶ of the persons owning looms and manufacturing cloth of various kinds. In all, there were twenty-one looms, four or five of which were not in working condition. Their owners were ordered to manufacture no cloth other than the coarsest qualities, such as was generally used for clothing slaves and for similar purposes.

Owing to the rush of the people to the gold and diamond region in search of sudden wealth, and to such discouragements as the above mentioned, and to the heavy duties⁷ laid upon cotton, whether exported

¹ *Revist. Inst. Hist. Braz.*, 1841, p. 439.

² While the habits of the people generally were simple and inexpensive, in the diamond district and in Rio de Janeiro they were at this time very extravagant. (See *Districto Diamantino*, por Dr. Joaquim Filicio dos Santos, p. 77.)

³ These instructions were accompanied by a decree, which, however, was to be published only in case of necessity. (*Revista do Instituto Historico do Brazil*, 1848, p. 213.)

⁴ *Revist. Inst. Hist. Braz.*, 1848, p. 213.

⁵ *Op. cit.*, 1848, p. 219, Art. 20.

⁶ *Revista do Instituto Historico do Brazil*, 1848, p. 232. *Loc. cit.*, pp. 234-7, gives a detailed account of the search for and location of these looms.

⁷ The cotton-packing in Bahia "is superintended by an officer authorized by Government, who puts a stamp upon it describing its quality, which enables the shipper to pass it through the custom-house, where it pays a heavy duty on exportation." (*Travels in the Interior of Brazil*, by John Mawe, 2d Eng. ed., p. 402.)

or used for domestic purposes,¹ together with the ease with which a competence could be obtained, very little or no advance was made during this period in the agricultural condition of the country.² But although the Crown of Portugal directed its attention almost exclusively to the development of the gold and diamond mining, various efforts were made to encourage agriculture during this period. In the instructions of the Government to the new governor of Parahyba, given in 1797, we find the following directions:

It should be your chief aim to animate and to aid the branches of agriculture already existing, and to introduce new ones that may tend to enrich that captaincy, taking care to increase the cultivation of sugar, tobacco, and cotton.³ * * *

EXPORTATION UP TO THE CLOSE OF THE EIGHTEENTH CENTURY.

The only statistics to be obtained of the exportation of cotton up to the end of the eighteenth century⁴ are those of the province of Maranhão,⁵ published in the report of the sugar and cotton exposition held in the city of Maranhão in December, 1883. From this list we can form an idea of the exports of the whole country up to the end of the eighteenth century.

Table showing cotton exported from Maranhão up to the end of the eighteenth century.⁶

Year.	Pounds exported.	Year.	Pounds exported.	Year.	Pounds exported.
1760.....	24,960	1774.....	.....	1788.....	2,179,968
1761.....	73,920	1775.....	.....	1789.....	2,283,072
1762.....	83,712	1776.....	391,584	1790.....	2,173,632
1763.....	140,352	1777.....	2,207,680	1791.....	2,445,120
1764.....	136,128	1778.....	1,400,832	1792.....	2,855,616
1765.....	288,768	1779.....	1,407,168	1793.....	2,594,496
1766.....	431,040	1780.....	1,423,488	1794.....	3,824,640
1767.....	487,872	1781.....	1,665,408	1795.....	3,219,904
1768.....	914,304	1782.....	1,903,488	1796.....	4,738,560
1769.....	978,048	1783.....	1,736,932	1797.....	3,625,340
1770.....	598,080	1784.....	1,832,256	1798.....	1,975,104
1771.....	155,712	1785.....	1,776,384	1799.....	5,855,424
1772.....	.....	1786.....	2,326,080	1800.....	5,529,408
1773.....	.....	1787.....	2,179,008		

¹ Royal decree of September 10, 1709, and of March 18, 1715.

² *Résumé de l'Histoire du Brésil*, par F. Denis, p. 174: "Pendant plusieurs années le Brésil resta dans un calme profond que approchait de l'inertie. L'agriculture, sans s'accroître beaucoup, avait acquis un certain degré de prospérité qui semblait exclure des perfectionnements venant des étrangers."

³ From the *Instruções do Governo para Francisco Delgado Freire de Castilho, Governador da Parahyba*. (See *Revista do Instituto Historico do Brazil*, 1844, p. 446.)

⁴ The Government committee for the revision of the tariff in 1882 emphasized the great difficulty of collecting statistics concerning the early exportation of cotton. They could obtain no information concerning the exports from Bahia, Ceará, Maranhão, Minas Geraes, Parahyba, and Pernambuco. (See *Relatorio da Comissão da Revisão da Tarifa apresentado ao Governo Imperial*, Rio de Janeiro, 1853.)

⁵ It is worthy of note that the Visconde de Porto Seguro, in his *Historia do Brazil* (II, p. 838-9), in reviewing the exports from Brazil about the beginning of the eighteenth century, mentions only gold, sugar, tobacco, hides, and Brazil wood, all of which were valued at 3,800,000 milreis.

⁶ From the *Relatorio da Exposição do Açúcar e Algodão em Maranhão*, 1883, p. 35.

But Maranhão stood only second among the ports exporting cotton, Pernambuco probably exporting more than twice as much, while Bahia, Rio de Janeiro, and Pará together exported about as much as Maranhão. In the absence of other and more detailed information upon the subject I quote from the Visconde de Porto Seguro's history of Brazil.¹ Speaking of the exports, he says there were "seventy thousand bags² of cotton, of which forty thousand were from Pernambuco, sixteen thousand from Maranhão, ten thousand from Bahia, and four thousand from Pará³ and Rio";⁴ and in another place⁵ he says that Ceará exported forty thousand sacks.

This article was very generally cultivated throughout the whole of Brazil, and even those captaincies that do not appear as exporters, must have produced very considerable quantities for home uses.⁶

The Visconde de Porto Seguro, in referring to the material prosperity of the country at this time, says that the productions of Brazil were sadly overloaded with duties and taxes. Cotton, among other articles, had to pay tithes, at first, when exported,⁷ and later even when consumed in the country.⁸ He mentions cotton as one of the principal products of Rio Negro,⁹ Piauhý,¹⁰ Rio Grande do Norte,¹¹ Parahyba,¹¹ Alagôas,¹² and Sergipe.¹² Adding to these the names of the provinces (ports) already mentioned as exporting cotton, namely, Pernambuco,

¹*Historia do Brazil*, II, p. 1064.

²A bag of cotton weighs 165 pounds. (See *Auxiliador da Industria Nacional*, vol. XL, p. 268.)

³In 1800 Pará alone exported 192,000 pounds of cotton. (See *Historia da Fundição do Imperio Brasileiro*, por Pereira da Silva, vol. I, p. 235. It should be added, also, that, aside from these figures, and the production of 48,000 pounds by Goyaz, Pereira da Silva says that this is the only trustworthy information he can give of the exportation of those times, because he does not give entire credit to what foreign authors say upon the subject.)

⁴It does not follow that the cotton exported from Rio de Janeiro was produced in that province. Most of the exports from that port came, in all probability, from the province of Minas Geraes. See Burlamaqui's *Monographia do Algodoeiro*, p. 89, where, in speaking of Rio de Janeiro, he says: "This province produces little or nothing. Up to a certain epoch there was some raw cotton exported which came from Minas.

⁵*Historia do Brazil*, II, p. 1674.

⁶The committee for the revision of the tariff, in their report to the Government in 1853, observed that, although statistics were wanting, and the history of industry and agriculture was hidden in obscurity, cotton was generally cultivated throughout the provinces of Brazil, and that spinning and weaving were family institutions. (See *Relatorio da Comissão da Revisão da Tarifa*, 1853.)

"Of the latter article (cotton) the immense quantity consumed in this country is scarcely credible." (*Statistical Review of Brazil*, by J. J. Sturz, p. 81.)

⁷Royal Letter of September 10, 1709.

⁸Royal Letter of March 18, 1715.

⁹Varnhagem's *Historia do Brazil*, II, p. 1070. Manoel da Gama Lobo died at Barcellos in 1799, where he had gone to establish, among other things, a cotton factory.

¹⁰Varnhagem's *Historia do Brazil*, II, 1073.

¹¹Varnhagem's *Historia do Brazil*, II, 1074.

¹²Varnhagem's *Historia do Brazil*, II, 1078.

Maranhão, Pará, Bahia, and Rio de Janeiro, and also that of Goyaz,¹ we have an idea of the extent of cotton culture, and of the amount grown at the time of the arrival of the royal family of Portugal in Brazil, at the beginning of the present century.

The adaptability of a large part of the drier sections of the country to cotton raising instead of sugar producing, the limited resources of the inhabitants, the small capital required for its cultivation, and the great and steadily increasing demand for the raw material in England, caused the cultivation of cotton already before the close of the last century to assume important proportions in Brazil.

Arruda da Camara says of this epoch:²

The information in regard to the great profits that cotton would pay those who cultivated it slowly penetrated the interior and awakened the planters. During the years 1777 to 1781 the people took new strength, and then it was that the interior was more thickly inhabited and better cultivated, and cotton culture and the cotton trade increased wonderfully.

Pompeo de Souza, speaking of the province of Ceará, says:³

The culture of cotton is the most ancient and the one that flourished most from the beginning of the present century up to 1822.

Mawe, in speaking of the production of cotton in Bahia, in 1809-'10, says:⁴

Cotton has of late been grown here in considerable quantities * * * and its plantations are daily increasing.

Upon the arrival of the royal family of Portugal, Brazil ceased to be a mere colony, and a new impetus was given to this as well as to other industries. The ports were made free to friendly foreign powers,⁵ and the decree prohibiting the use of looms for other than the coarsest kinds of cotton was revoked.⁶

Cotton had now become a regular and constantly increasing article of exportation, being in such demand and commanding such prices that it was brought from great distances inland on the backs of mules and horses, and over roads almost impassable.⁷

Near the close of the eighteenth century the United States entered the market as a cotton producer. The effect of this new rival in one of the most important branches of her agriculture is sufficiently well shown by the appended tables of exports, pp. 45, 46.

¹ Pereira da Silva, in his *Historia da Fundição do Imperio Brasileiro*, vol. I, p. 235, says that in 1806 Goyaz produced 48,000 pounds of cotton.

² *Memoria sobre a Cultura dos Algodoeiros*, Arruda da Camara, chap. I.

³ *Ensaio Estatistico*, p. 353.

⁴ *Travels in the Interior of Brazil*, by John Mawe, p. 294, Am. ed.

⁵ Varnhagem's *Historia do Brazil*, II, p. 1081.

⁶ (April 1, 1808.) *Revista do Instituto Historico do Brazil*, 1348, p. 239. There were, however, four separate duties collected by the Government on cotton at this time, one of which was 100 reis (about ten cents at that time) on each bale of 160 pounds. (See Varnhagem's *Historia do Brazil*, II, 1093-94.)

⁷ In 1809 cotton was carried from Minas Novas to Rio de Janeiro, a journey requiring from three to four months for a troop of mules. (See *Travels in the Interior of Brazil*, by John Mawe, p. 340.)

EXTENT OF CULTIVATION. *L*

The territory in Brazil capable of yielding cotton is coextensive with the empire itself. I have myself seen cotton growing in almost every one of the provinces, and in regard to the others there exists no doubt whatever.¹ Auguste de Saint-Hilaire, in his *Flora Brasiliæ Meridionalis*,² says the southern limit of cotton culture in Brazil is the Serra das Furnas in the province of Paraná. He repeats this statement in a subsequent publication,³ but adds that on the plateaux it is cultivated as far south as Porto Alegre in Rio Grande do Sul. My own observations confirm the statement of M. de Saint-Hilaire. During a voyage to South America in 1880-'82, I noted the growth of cotton at the head of navigation upon the Rio Araguaý, north of the mouth of the Amazon, which point is the most northern one inhabited by civilized whites in Brazil along the coast in this direction. I found it also at Macapá and Mazagão, and upon the islands forming the delta of the Amazon. It was seen also at Santarem on the Tapajos, and again at Manaus, at the mouth of the Rio Negro. Bernardino de Souza says⁴ it grows perfectly at Obidos, and that there are small patches of it belonging to every small farm, but that the quantity is not sufficient for the wants of the place. In 1819 it was exported from what was then the captaincy of Rio Negro, now the province of the Amazonas.⁵

Various authors, some of whom have already been cited, mention cotton as being grown on the Tapajos and Madeira Rivers. Lieutenant Gibbon mentions that at Ocron, a small town near Tarma, in Peru,⁶ "Cotton grows upon small trees."⁷ Lieutenant Herndon also mentions⁸ it as growing near Tarma, where it is "a tree, some eight or ten feet high. * * * The quality, particularly that of Chanchamayo, is very superior." Lieutenant Gibbon also noticed cotton grown by the people in northern Bolivia, near the Brazilian frontier. "Over three thousand yards of Indian domestic cotton cloth were also exported last year" (*i. e.*, in 1851).⁹

¹ "Owing to her climate and geographical position the vegetable zones of Brazil are not as marked as those of other countries. It would be difficult to divide the whole empire with reference to its productions into three great regions." (*A Journey in Brazil*, by Prof. and Mrs. Louis Agassiz, p. 504.)

² *Voyage dans le District des Diamans*, vol. II, p. 254.

³ *Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, vol. II, p. 107.

⁴ *Valle do Amazonas*, por Bernardino de Souza, p. 244.

⁵ *Revista do Instituto Historico do Brazil*, 1848, p. 469. The exports for that year were 190 arrobas (6,060 pounds), unginned, valued at 152 milreis.

⁶ Cotton was used in Peru prior to the invasion of the Spanish. (See *Auxiliador da Industria Nacional*, 1878, p. 90.)

⁷ *Exploration of the Valley of the Amazon*, part II, by Lardner Gibbon, p. 29.

⁸ *Exploration of the Valley of the Amazon*, part I, by Lieutenant Herndon, pp. 85-86. He adds also (p. 86) that "it is the black seed cotton, and when picked off leaves the seed perfectly bare and clean. There is also nankeen colored cotton here, the trees seeming in every respect like that of the white."

⁹ *Exploration of the Valley of the Amazon*, part II, by Lieut. Lardner Gibbon, p. 233.

In the year 1874 good specimens of cotton were sent to Rio de Janeiro from Matto Grosso,¹ and were examined by the Sociedade Auxiliadora da Industria Nacional.² In 1881, I, myself, saw in Matto Grosso the small quantities, such as are usually grown in all parts of Brazil so far removed from a market. Descending the Paraguay River I found it in various places, though generally in small quantities, as far south as Asuncion in the Republic of Paraguay.³ In regard to its culture in the province of Rio Grande do Sul, M. Auguste de Saint-Hilaire, as has been remarked, says that it grows upon the highlands as far south as Porto Alegre.

M. Aimé Bonpland, the companion and friend of Humboldt, who lived for a number of years in the Argentine Republic, just across the Uruguay River from Brazil, says that cotton is not worth cultivating on the Uruguay.⁴ From this it is to be inferred that small quantities may be cultivated in the extreme south of Brazil, although it is not, and is never likely to be, cultivated there to such an extent as to render it profitable. In Santa Catherina, and, in fact, in all the provinces south of São Paulo, the production is possible, but, for various reasons, it is quite insignificant as far as any exportation is concerned.

From São Paulo all along the coast to the Amazon, and, for that matter, throughout the whole empire, cotton might be grown in almost unlimited quantities; in reality, however, it is only cultivated to any considerable extent in the drier regions of the north, and along the valley of the Rio São Francisco, and in some parts of the province of Minas Geraes. In the north, *i. e.*, to the north of Sergipe, a belt about fifty miles wide along the coast is, for the most part, devoted to the production of sugar.⁵ Immediately beyond this is the region in which cotton is actually grown, the width of which region depends almost solely

¹*Auxiliador da Industria Nacional*, 1875, p. 51.

²*Auxiliador da Industria Nacional*, 1875, pp. 182, 183.

³The *Auxiliador da Industria Nacional* 1868, p. 152, says that in Paraguay cotton occupies a great deal of the land, and that the crops are considerable. Ullóa says that "cotton contributes considerably to their [the Paraguayans'] riches, growing here in such quantities, that every little village gathers of it annually above two thousand arrobas." Captain Page adds that while both climate and soil are admirably adapted to its culture, owing to the importation of foreign goods it was no longer cultivated in 1853. (See *La Plata, the Argentine Confederation and Paraguay*, by Capt. Thomas J. Page, p. 240.)

⁴*La Plata, the Argentine Confederation and Paraguay*, by Capt. Thos. J. Page, p. 296.

⁵Koster, who traveled in the north of Brazil, and whose writings cover the period from 1809 to 1815, says: "The opinion is very general that the cotton plant will not thrive in the neighbourhood of the coast." He adds in a foot-note: "I have seen some fine cotton shrubs at the distance of one or two leagues from the sea-coast; but the attempts that have been made to cultivate it to any extent in such situations have not, from what I have seen and heard, met with the desired success." (*Travels in Brazil*, by Henry Koster, 2d ed., vol. II, pp. 167, 168.)

Gardner, referring to the articles exported from Aracaty, in Ceará, says: "But little cotton is cultivated near the coast, the greater part of it * * * being brought from the interior." (*Travels in the Interior of Brazil*, by George Gardner, pp. 155, 156.)

upon the distance which the producers feel themselves able to transport it. Their only means of transportation is upon the backs of horses, the railways extending into the region being too few, as yet, to influence to any marked degree the amount of cotton produced.¹

As cotton culture has receded from the coast the question of transportation has become a very serious one with the Brazilian planters. Roads are so poor² and markets so far away that they must necessarily lose the greater part of their profits in the expense of transportation, and there is a correspondingly small interest taken in the production of cotton. The remedy generally recommended is railways, but railways, where they already exist, have not in all cases, been found a remedy for this state of affairs. Cotton sent by rail from the interior of the province of São Paulo to the seaboard at Santos pays out, in freight, about 13 per cent. of its value.³ The planters of Flores, Triumpho, and Villa Bella, in Pernambuco, pay out from 25 to 30 per cent. of the value of their cotton in freights.⁴ From Bonito, in the province of Pernambuco, cotton might be sent in a day to the railway station at Una, and shipped thence to Recife, but instead, the owners, without exception, prefer to send it all the way to Recife on horseback, and over bad roads, a trip that requires a number of days. Upon inquiring the explanation of this method of reaching the market, I was told that the freight rates charged by the railway, together with the cost of reaching the railway, were higher than the charges of the owners of horses going directly to Recife; that when sent on the backs of horses the cotton was delivered at once in any part of the city, whereas, if it went by rail it would have to be moved again probably

¹ There are at present no railways in Bahia, Sergipe, or Alagôas running sufficiently far inland to be of any avail to cotton-growers. One road now building in Bahia will, however, reach the cotton region. In Pernambuco the Limoeiro road barely reaches the edge of the cotton region, while the extension of the Recife ao São Francisco road, now under construction, will reach the cotton belt in the southern part of the province. In Rio Grande do Norte the Natal railway will probably be of some local use in getting the cotton into the market, while in Ceará the Baturité and Sobral railways have but little cotton to transport, though they both run into regions that might produce large quantities.

² Poor roads are a great drawback to Brazilian agriculture, and to development generally. They have been and are still complained of, though but little is done to improve them. The *Relatorio da Comissão da Praça do Maranhão*, 1877, p. 15, has the following upon this subject: "One of the greatest difficulties with which the agriculture of this province has to deal is the want of good roads, so much so that it is only by laborious efforts that the planters succeed in taking their produce to the ports of embarkation."

The *Ligeiro Estudo sobre o Estado Economico e Industrial do Maranhão*, por Fabio Alexandrino de Carvalho Reis, p. 29, says: "Our common roads are detestable, and river communications need great improvements to render them freely navigable to steamers."

³ *Relatorio da Associação Commercial de Santos*, 1882, p. 20.

⁴ *Falla com que Dr. Adolpho de Barros Cavalcante de Lacerda, presidente da provincia*, &c., 19th December, 1878, p. 58.

after paying storage; and that the formalities of the railway were perplexing and annoying. Along the large streams where it is possible to ship cotton by water, it can be moved with greater facility. On the Rio São Francisco navigation is interrupted at the falls of Paulo Afonso, so that the region benefited by its navigation is comparatively small.¹ Above the falls some cotton is carried on horseback as far as Bahia, or was formerly, while the greater part is for home consumption only.²

Through the more northern part the people depend somewhat upon the river navigation to move their cotton; but, on the whole, the means of transportation used is horseback, and it is thus brought to market, traveling 300 miles over roads that are nothing more than bridle paths, and often very bad ones at that;³ and I have been told that it was no extraordinary thing for it to be carried 400 miles in this manner. In some parts of southern Brazil it was formerly taken to market on ox-carts, traveling hundreds of miles over bad roads.⁴

As a rule, then, it may be said that the cotton belt in the north begins about 50 miles inland from the coast, and just within the sugar belt, and extends about 200 miles inland, more or less. To the south, as it approaches the province of Bahia, it swings inland, and keeps mainly within the region drained by the Rio São Francisco. In the more southern provinces, from Espirito Santo and Rio de Janeiro,⁵ south-

¹ The Brazilian Government is now having the navigation of the Rio São Francisco above the falls improved according to the plan of Col. W. Milnor Roberts, and a railway is already built around the falls, touching the river at Piranhas, the head of navigation on the lower river.

² "Raw cotton does not pay for collecting it for exportation in the more remote parts of the province of Minas, where soil and climate combine to produce a better quality than can be got from lands more adjacent to the coast." (*Statistical Review*, by J. J. Sturz, p. 112.)

³ John Mawe, the first foreigner allowed to visit the mining district of Brazil (1809), speaking of Minas Novas, says: "The plantations are chiefly of cotton, which is reputed to be equal in color and quality to that of Maranhão. It is transported to Rio de Janeiro on mules, and many hundreds of these useful animals are continually employed in this commerce. A troop of loaded mules are full three months, and sometimes four, in going, and the same in returning. * * * The average burden is 9 arrobas (288 pounds), * * * the carriage expense of which from Rio de Janeiro to Minas Novas is £6 or £7 sterling." (*Travels in the Interior of Brazil*, by John Mawe, 2d Eng. ed., pp. 339 and 340.) I can testify to the almost impassible character of the roads in the upper part of the province of Minas Geraes. It would be impossible for any other animals than mules or llamas to carry loads over them. Raw cotton is now no longer exported, the several factories in the province consuming all that is produced.

⁴ *Voyage dans les Provinces de Saint Paul et de Sainte Cathérine*, par Auguste de Saint Hilaire, vol. I, p. 224, foot-note. The author says that some of the people living near the border of the province of Rio Grande do Sul carry their cotton on ox-carts to São Paulo, "et mettent trois mois à faire ce voyage, qui est de 158 legoas pour l'aller et le retour," that is, about 250 miles.

⁵ "Cotton, and more especially the herbaceous, can be cultivated in the province; the results of trials, however, did not satisfy the expectations of those who planted it." (See *Agricultural Instructions*, 1876, by Dr. Nicolau Joaquim Moreira, p. 56.)

ward, the amount of cotton produced at present for exportation is very insignificant or nothing. Formerly, especially during the prevalence of the high prices caused by the civil war in the United States, cotton was grown in some of these southern provinces for exportation, principally in those of Rio de Janeiro and São Paulo.¹

One notable exception to the absence of cotton grown near the ocean is furnished by the island of Fernando de Noronha. I was informed by the governor of this island that the cotton grown here during and for a short time after the civil war in the United States was the finest sent from any part of Brazil,² and was comparable, in quality to the sea-island cotton. Dr. Nicolau Joaquim Moreira, one of the best authorities in Brazil upon agricultural matters, also testifies to the excellence of the cotton grown on Fernando de Noronha, and says that it "is not inferior to the best sea-island of Georgia."³

When I visited this island in 1876 cotton was no longer cultivated on it. The press-house was in ruins, and the governor of the place was giving his attention to the cultivation of sugar, corn, and beans. In 1883 efforts were being made to renew cotton-culture on the island. The soil of Fernando de Noronha is remarkably fertile, and although it is used as a convict island, it is one of the best cultivated pieces of soil in Brazil.

VARIETIES CULTIVATED.

It is not my purpose to enter into any detailed description of the species and varieties of cotton grown in Brazil, but only to give the general characteristics of the more commonly cultivated varieties, applying to them the names by which they are there known. It is not to be supposed, however, that only native species are grown,⁴ or indeed that any of the kinds commonly cultivated are native,⁵ although it is quite possible that one species at least, supposed by some authors to be exotic, is indigenous to South America.

The time allowed me for making observations upon cotton and the insects affecting it was too short to allow any study of the varieties of this plant under cultivation. I was able to do nothing more than to collect what information was to be had from the planters themselves.

¹ See statistics of exportation from these provinces.

The *Relatorio da Associação Commercial de Santos* for 1882. p. 20, has the following: "It is seriously to be lamented that this branch of agriculture, which once reached a high degree of development in our province [São Paulo], is now abandoned."

² Claude d'Abbeville found "much cotton and corn" growing upon this island in 1612. (*Historia da Missão dos Capuchinos*, p. 50.)

³ *Noticia sobre a Agricultura do Brazil*, por Dr. Nicolau Joaquim Moreira, p. 26.

⁴ "In 1796 Minister Luiz Pinto de Souza sent to Bahia the seed of Persian cotton and Arabian coffee." (*Historia do Brazil*, pelo Visconde de Porto Seguro, vol. II, p. 1078.)

⁵ Burlamaqui refers to a wild ("*algodoeiro selvagem*") cotton in Brazil, but it yields so little fiber—but 3 to 4 oitavos of clean cotton—that it is not worth cultivating. (*Monographia do Algodoeiro*, por Dr. Burlamaqui, p. 13.)

The names by which the more commonly cultivated varieties are known are as follows :

Crioulo, inteiro, arboreo, or Maranhão; Quebradinho, quebrado, or quebradiço; Herbaceo, black and white, riqueza, and dwarf; Verdão, caroço verde; Carrapicho; Macaco, algodô, algodim, algodão pardo, algodão fulvo or yellow cotton.

These names are not all from the same locality, and it is quite possible that in some cases two or more of them are applied to the same variety of cotton, as so often happens in regard to other plants. Planters, as planters, seem to know of but three kinds,¹ and even in these three the differences are not always persistent.

The kind known as *crioulo* (inteiro, arboreo, or Maranhão) has been cultivated, according to Arruda da Camara, since 1796. I quote here that writer's remarks upon this variety of cotton :

Maranhão cotton, as it is called here, though it perhaps does not exist in Maranhão, is somewhat larger than the ordinary cotton plant,² and the leaves larger, though strong; the bolls twice as large, containing seventeen seeds in each, while the ordinary cotton has but seven. The staple is more abundant, so that three arrobas with seed yield one of clean cotton, while, of the ordinary, four arrobas are required to make one. It was only the last year, 1796, that this cotton began to be cultivated, and there is still but little of it.³

As described to me by the Brazilian planters the peculiarity distinguishing the variety known as *crioulo*⁴ is that the smooth black seeds cling so firmly to each other⁵ that they only separate when pressed rather strongly between the fingers, and the fiber can be stripped from them without separating them, and without leaving any lint upon them. Exporters of cotton prefer this variety to any other because the fiber is said to be longer. The plant is a large bush reaching from five to fifteen feet in height,⁶ and the bolls are large as compared with the kind called *quebradinho*. When the cotton is ripe, it still clings closely within the boll, and never protrudes like the herbaceous.

Quebradinho (*quebrado* or *quebradiço*).—The only characteristic distinguishing this variety from the preceding one is that the seed, instead of clinging tenaciously together, separate readily from each other. The seed and bolls are smaller than those of *crioulo*. In the province of Maranhão these varieties (*crioulo* and *quebradinho*) are known as *arbo-reo* or tree cotton.

¹A writer in the *Revista Industrial*, 1873, p. 131-132, makes out five varieties. (See also answers to circular.)

²I have taken it for granted that the kind referred to by Arruda da Camara is the same as the one known by that name nowadays, and that his "ordinary cotton plant" is the kind now known as *quebradinho*, *quebradiço*, &c.

³*Memoria sobre a Cultura dos Algodoeiros*, por Arruda da Camara, chap. II.

⁴This word is sometimes wrongly spelled *criullo*, *criollo*, &c.

⁵The name *inteiro* (entire, whole), which I have from the Rio Tocantins, in the interior of Ceará, is probably given on account of this peculiarity.

⁶Dr. Burlamaqui, in his *Monographia do Algodoeiro*, p. 10, gives the height of *Gossypium arborens* as 15 to 20 feet. Whether this is the species referred to, I am unable to say.

The plants of the two preceding kinds and the *algodoim* (yellow cotton) are very hardy, and if properly cared for will last for a number of years. They do not, however, yield crops worthy the name for more than two years, or three at the most, and under the most favorable circumstances, with the system of agriculture in vogue in Brazil. But they are frequently allowed to stand upon the ground the third and even the fourth year, and the haphazard crop is picked if it should be considered worth the trouble.¹ The picking of these varieties is more difficult than that of the herbaceous, owing to its clinging so much more firmly within the less-opened bolls.

Of these varieties from five hundred to five hundred and thirty kilos are required to yield one hundred and fifty kilos of clean cotton.² According to Captain Page,³ a single plant yields four pounds of cotton in the seed.

¹ I found a variety of opinions, more or less conflicting, upon the subject of the number of years Brazilian cotton bears. It will be seen that the answers to the circular keep between two and four years as the limits of production, the majority of them giving two years. Arruda da Camara, in his *Memoria* on the culture of cotton, chap. IV, says that in the dry, hot zone of the interior, the cotton plant lasts ten, twelve, and fourteen years, and even longer, if it is properly cared for. In Chap. V he says that after plants have borne for four years they are exhausted and have to be cut off near the ground.

Dr. Burlamaqui, in his *Monographia do Algodoeiro*, p. 51, says that it may yield for two or three years in succession. Again, on p. 61, he says that "certain species may last for twenty years, though they generally last ten or twelve. Moreover the yield generally diminishes, so that it is not worth while to keep the fields more than ten years. In some places they are renewed every four years, a matter that depends upon the ground, the species, and the climate."

Dr. Nicolau Joaquim Moreira, in his *Noticia on Agriculture in Brazil*, p. 26, says that *crioulo*, *caiana*, and *quebradiço* last for twelve years.

Dr. Antonio Rego, in an excellent short article upon cotton in Maranhão, published in his *Almanack do Poro para 1867*, says the yield is for three consecutive years, though that of the third year is not so great as upon the two preceding ones.

The *Revista Agricola do Imperial Instituto Fluminense de Agricultura*, March, 1881, p. 29, says the cotton plant yields for three years.

Auguste de Saint-Hilaire, in his *Voyage dans le District des Diamans*, vol. II, p. 250, says, "Ce végétal produit trois années de suite," in the province of Espirito Santo.

While there can be no doubt about plants lasting a great number of years under favorable circumstances, no serious planter thinks of getting anything like a good crop from plants that have borne for two years already. I should not fail to give, in this connection, the statement of the oldest authority upon cotton-growing in Brazil, Gabriel Soares de Souza (*Revista do Inst. Hist. do Brazil*, 1851, p. 202), who wrote about 1580, and who says that the plants last seven and eight years and longer. But in those days planters were doubtless satisfied with crops that nowadays would scarcely be considered worth gathering.

² The *Auxiliador da Industria Nacional*, 1868, p. 39, gives the yield as one-quarter cotton to three-quarters seed by weight.

³ *La Plata, the Argentine Confederation and Paraguay*, by Capt. Thomas J. Page, U. S. N., p. 290.

*Herbaceo*¹ (*herbaceo preto*, *herbaceo branco*, *riqueza*,² *algodão do governo*,³ *verdão*,⁴ *caroço verde*, *rasteiro*, *alvão*,⁵ and *Malta*⁶).—The plant of this species does not grow as tall as the *crioulo* or *quebradinho*, though some planters assert that it grows taller now than it did when first introduced into Brazil.⁷ It then grew only about 3½ feet high; now it often reaches 5 feet. One variety of this herbaceous cotton is a dwarf (*rasteiro*). While the yield of this quality is good, its nearness to the ground is regarded as a serious objection to it, for it is necessary to keep the ground clear of all weeds and undergrowth to prevent the cotton being injured by rubbish.⁸

The seeds separate in the bolls and the ripe cotton hangs from them in large flocks. When the cotton has been removed from the seed, a lint still remains upon them, except in the case of the *algodão do governo*.⁹ This peculiarity probably gives rise to the name of a variety known as *verdão*, and *caroço verde* (green seed), in which the seed have a greenish or bluish tinge. In some places it is called *riqueza* (wealth).¹⁰

This species (*herbaceo*) produces more fiber, sometimes from five to six times as much as either of the preceding kinds, but the plant lasts only one year, and the fiber is regarded as an inferior quality, fetching five hundred reis, or about 25 cents, an arroba (32 pounds) less in the market.¹¹ According to Father Fonseca, on a given piece of ground the herbaceous yield is four times as large as that of tree cotton, while, in picking, one can gather twice as much from the herbaceous in a given time.¹² In general, it may be said that the herbaceous having been received with so much favor and now being generally planted, speaks for itself.

¹ I am unable to say whether this "herbaceous" cotton is *Gossypium herbaceum* of Linnaeus. Dr. Burlamaqui takes it for granted that it is, and says that the name is misleading, because although at times the plant reaches only 18 to 20 inches in height, it at other times reaches from 4 to 6 feet. (See *Monographia do Algodoeiro*, p. 9.)

² This name is applied to herbaceous cotton along the Rio São Francisco and in some parts of the province of Minas Geraes. It is said to be "in allusion to the abundance of bolls on a single plant." (See *Tratado do Algodoeiro no Brazil*, pelo Major Taunay, pp. 55, 56).

³ Father Antonio Caetano da Fonseca, in Taunay's *Tratado*, p. 56, says this name is used in Minas Geraes. The seeds are left clean when the cotton is ginned.

⁴ Probably the kind referred to by Dr. Moreira as "big green" in his *Agricultural Instructions*, p. 59.

⁵ I take this "*alvão*" to be nothing more than a mispronunciation of the word *herbaceo*.

⁶ *Revista Agricola do Imperial Instituto Fluminense*, September, 1870, p. 9.

⁷ The *Auxiliador da Industria Nacional*, 1876, p. 133, speaking of herbaceous cotton, says: "It may become arborescent, diminishing, in this case, the number of its bolls."

⁸ I surmise that the ease with which herbaceous cotton gets soiled before leaving the field is one of the principal reasons of the lower price paid for it in the markets.

⁹ *Tratado do Algodoeiro*, pelo Major Taunay, p. 56.

¹⁰ See reply No. 2 to circular.

¹¹ This in the province of Pernambuco.

¹² *Tratado do Algodoeiro*, pelo Major Taunay, p. 52.

In the Republic of Paraguay, Captain Page¹ found, in 1854, that a practical American cotton-grower, after experimenting with the perennial, had abandoned it, and was planting the herbaceous.

The yield of clean staple in the province of Pernambuco is 150 kilos from 400 kilos in the seed.² In São Paulo, 101 pounds with the seed yield 32 pounds of clean cotton.³

But although a large yield is the rule, as compared with that of the perennial plants, it is not always certain, for it not unfrequently happens that when there is an adverse season, or caterpillars, the more robust and woody *crioulo* or *quebradinho* yield better than the herbaceous.⁴

I was informed that this herbaceous cotton was introduced into Brazil from the United States. I am unable, however, to answer for the trustworthiness of this assertion,⁵ though there is no doubt about its having been introduced within a comparatively short period.⁶

The only other quality deserving attention is known by the several names of *algodoim*,⁷ *algodoi*, *algodão pardo*, *algodão fulvo*, *algodão amarello*, and *algodão macéco*.⁸ This variety is of a yellow or light brown color, and is not grown in any considerable quantities, owing undoubtedly to its color and to the small yield of fiber,⁹ which is only about

¹ "Our countryman, Mr. Yeatman, is struggling hard against weeds, thistles, want of labor, &c., in the cultivation of cotton. He has been at work for a year and a half, and thus far has failed entirely. He is now planting American cotton with the hope of better success. He intends planting every year. He found that the perennial plant, after it had attained a growth of a year or more, deteriorates, and if not worked the annual product will be less and less. I am satisfied, after all that has been said in favor of it, because of the economy of labor, that the cultivation of the annual plant will prove much more profitable, notwithstanding the necessary yearly preparation of the ground." (See *La Plata, the Argentine Confederation and Paraguay*, by Thomas J. Page, p. 290.)

² The *Auxiliador da Industria Nacional*, 1868, pp. 38-39, gives the yield as one-third clean cotton for two-thirds seed, by weight. Dr. Burlamaqui, in his *Monographia*, p. 67, quotes Spix and Martins as saying that the poorest Maranhão cotton yields one-third staple, by weight.

³ Notes of W. T. Gepp, taken in the province of São Paulo, in 1876.

⁴ See Reply No. 1 to circular.

⁵ The *Auxiliador da Industria Nacional*, 1868, p. 39, says it was introduced into Rio Grande do Sul by Edward von Borusky. No date is given. Father Antonio Caetano da Fonseca says the variety known as *riqueza* had been planted for more than twenty years previous to 1862; that is, since about 1840. (*Tratado do Algodoeiro*, pelo Major Taunay, p. 55.)

⁶ *Almanack do Povo para* 1867, pelo Dr. Antonio Rego, Maranhão.

⁷ There seems to be a difference of opinion in regard to the origin of this brown cotton. Dr. C. F. P. von Martius says that it is a native of Siam, while Brazilians claim that this particular kind is a native of Brazil. (See *Revista do Instituto Hist. Braz.*, 1843, pp. 262-263, art. by Antonio Ladislau Monteiro Baena.) "Tambem equivocou o sobredita naturalista co'o algodão terrantez, chamado algodoim." This yellow cotton is found growing wild in Maranhão. (See *Exposição do Assucar e Algodão*, 1883, p. 59.)

⁸ This is the name used by Arruda da Camara, and is still used in some parts of Brazil. (See *Memoria sobre a Cultura dos Algodoeiros*, chap. II.)

⁹ Burlamaqui, *Monographia do Algodoeiro*, p. 16.

three ounces of clean cotton for each plant. The color is not generally considered an attractive one, but it is valued for certain household articles, and especially for hammocks, because of its never fading. It has never reached the point of being produced in any sufficient quantities¹ to be exported, though an instance is given² of a Maranhão planter sending a lot of it to England for the purpose of having it made up and returned to him for clothing. It is used now principally for making hammocks. The plant lasts for several years, and in general is like the *crioulo*, except in regard to color.

None of these varieties of cotton produces more than one crop per annum, many assertions to the contrary notwithstanding. The even temperature throughout the year and the favorable weather lengthen out the picking time to several weeks and even months, and it is possible that those who state that there are two or more crops in a year are confusing the various pickings with crops.³

In connection with the subject of the varieties of cotton grown in Brazil, it should be mentioned that efforts have been made to grow sea-island cotton, but without success.⁴

It is often given as a characteristic of cotton from certain provinces and localities that it is dirty.⁵ While this may be true, it is due, not to any peculiarity of the cotton itself, but to the manner in which it is handled.

METHODS OF CULTIVATION. —

Such methods of cultivation as are generally given by the agricultural periodicals in Brazil must not be mistaken for descriptions of the methods actually practiced by the planters. Such articles have been written rather for the purpose of inducing planters to improve the system of cultivation in use, and are largely taken from American and other foreign works upon this subject.

In the *Roteiro do Brazil*, already referred to, by Gabriel Soares de Souza,⁶ who lived in Brazil from 1570 to 1585, is a very brief description

¹ "The yellow or nankeen cotton is likewise to be found at Pernambuco, but it does not form an article of cultivation, being regarded rather as a curiosity." (*Travels in Brazil*, by Henry Koster, vol. II, p. 176.) I have seen this cotton growing in the province of Matto Grosso.

² Dr. Antonio Rego's *Almanack do Poro para 1867*, Maranhão.

³ The *Auxiliador da Industria Nacional*, 1876, p. 135, has the following upon this subject: "Como a planta não deixa de produzir, a colheita quasi que é continuada." *Op. cit.*, for 1863, p. 106, says: "A planta sómente deixa de produzir sob a acção dos fortes invernos."

⁴ In 1872 the Brazilian consul in New York sent to the Minister of Agriculture of Brazil twelve bushels of sea-island cotton seed. (See *Revista Agricola do Imperial Instituto Fluminense*, September, 1872, p. 43; see also note on the cultivation of cotton on the island of Fernando de Noronha, p. 25.)

⁵ An article in the *Revista Industrial*, 1878, p. 132, says that cotton from Maranhão, Pará, and the Amazonas is not clean.

⁶ *Revista do Instituto Historico do Brazil*, 1851, p. 202.

of the way in which cotton was cultivated in those days, and which suggests much that might be said in regard to Brazilian methods in agriculture generally. Says the author referred to:

These cotton trees last seven and eight years and more, if the ends of the large branches are broken off (for they dry up), in order that they may put forth other new and more vigorous ones. These cotton plants are cleared with the hoe two or three times a year to keep the grass from crowding them.

This is doubtless, in a few words, the whole process of cultivation then in use in Bahia, and probably in all Brazil.

Arruda da Camara, in his *Memoria* (1749), chapter V, on "the best way to plant cotton," has these words: "The only agricultural tool to be used in cotton planting is the hoe."

Substantially the same system is used to-day that was in vogue three hundred years ago,¹ a fact which may be verified by turning to the answers received from my circular questions.

Dr. Cleary, of Santa Catherina, a gentleman who has lived in Brazil nigh to twenty years, says (answer No. 17): "* * * Its cultivation is in the most rudimentary style, amongst a people who despise and refrain from the use of the plough." See, also, reply No. 6, answers 6 and 10; reply 5, answer 10, and reply 4, answer 10. Reference to the other replies to question No. 10 will show that plows are never used, and that the hoe is the instrument in common use, and indeed almost the only one.²

In regard to the preparation of the soil generally, I can give nothing more concise or expressive than the words of Auguste de Saint-Hilaire: "All the planter has to do is to burn off the woods and plant his seed at the proper season."³ This is the whole story. There is no uprooting of stumps, no digging out of sprouts, no breaking up with the plow, no preparation of the soil, no laying out of furrows, no cultivation other than the occasional chopping out with the hoe of weeds or sprouts.⁴ One may therefore imagine that the cultivation of cotton is almost with-

¹ "Our methods of cultivation and manufacture have made but little improvement upon those used by our ancestors in colonial times." (*Cartas a Um Amigo Velho*, by Fabio Alexandrino de Carvalho Reis, published in *O Paiz* of Maranhão, 1877. Reprint, pp. 29-30.)

² I am aware, however, that the plow is slowly coming into use in the province of São Paulo, and it is possible that it was used there in the cultivation of cotton during and for some time after the civil war in the United States. I have also seen a few plows in the province of Sergipe, and Auguste de Saint-Hilaire says that they are used in Rio Grande do Sul (*Voyage au Brésil*, vol. I, p. 193). The number, however, is not sufficient to modify the statement, except perhaps in regard to the province of São Paulo, that the hoe is the only agricultural instrument in common use.

³ "Tout le talent du cultivateur consiste à brûler ses bois, et à semencer en temps convenable." (*Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, [1816], vol. I, p. 233.)

⁴ "On se contente de couper les mauvaises herbes au pied. C'est à ce léger travail que se borne toute la culture des cotonniers." (Aug. de Saint-Hilaire, *Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, vol. I, p. 404.)

out labor. The writer just referred to very truly says, in another place,¹ that "nothing in this country is less expensive or more productive than cotton culture."

Rotation of crops is almost entirely unknown. Fields are seldom laid out with any definite forms, as they would be if the plow were in common use, but vary to suit the convenience of the planters, adapting themselves to the natural features of the surface and character of the soil. If the place to be planted is forest, whether heavy or of only a few years' growth, the laborers, with bill-hooks for the undergrowth and axes for the trees, begin clearing it from one side, felling the trees and undergrowth toward the open space, and leaving stumps of any height that may make the work of clearing easier. No effort is made to pile the brush in heaps. This work is done in the dry season, and the brush is allowed to lie for several months, until the approach of the rainy season, when the whole, being thoroughly dried by long exposure to the rays of a very hot sun, is set on fire. The want of arrangement of the branches permits the burning of all the leaves and of the small limbs, twigs, &c., but the larger ones, and the trunks of fallen trees, are only blackened by the passing fire. A more desolate sight cannot be imagined. Sometimes some of these half-burned pieces are piled together and set on fire, and sometimes they are allowed to lie where they happen to have fallen.² The soil is now ready for the seed. The laborers go over the field with large, heavy hoes, and with powerful blows open holes to receive the seeds at intervals more or less irregular. The spaces between the hills are generally supposed to be from five to eight palms, according to the fertility of the soil. Sometimes rows are attempted in a rude, rambling way, and in such cases the hills are about six palms apart in one direction and eight in the other, according as the stumps and logs and half-consumed limbs will permit. The cotton seed are planted in these holes, and with the foot or hand covered with a little earth.

The planting season varies in different localities according to the time when the rains generally set in. Most of it is done in the months of February and March,³ though planting-time may vary a month or more either way, according to the season and the nature of the ground, low, rich soil generally being planted later than the dry uplands. Difference is also made with the kind of cotton, the tree cotton generally being planted a month or two earlier than the herbaceous. Sometimes

¹ *Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, vol. I, p. 404.

² Hans Stade describes this method of preparing the soil for crops as practiced among the native Indians of Brazil, shortly after the discovery. Auguste de Saint-Hilaire says the Indians used to plant in this way, and he was also informed by native Africans that the same custom was practiced in Bengal. (See *Voyage aux Sources du Rio São Francisco*, vol. I, pp. 16, 17.)

³ "A Minas Novas, le semis du cotonnier se fait ordinairement en Octobre." (Denis, *L'Univers : Brésil*, p. 356.)

other things are planted between the rows of cotton, such as beans, rice, corn, &c.

Shortly after the planting the season of rains sets in, and cotton, weeds, sprouts and all come up, and grow with a vigor and rapidity only to be seen in the tropics. When the cotton is about to be choked out by useless vegetation, the hoes are sent to chop it out, an operation that is performed two or three times, or as often as circumstances are supposed to require it during the year. The amount of cleaning required by a field depends upon the richness of the soil and upon the length and character of the winter, rich soil and long, wet winters producing more weeds and requiring more attention. So far as tillage is concerned, this is the only cultivation the plants receive, and the soil becomes almost as hard as a brick.¹

In order to make them branch more, it is the custom in some parts of the country, as in Maranhão and Minas,² to cut off the tops of the growing plants, and sometimes of the larger branches also, a custom which has been practiced in Brazil from the earliest times (1570).³

After the first crop the varieties of tree cotton are often cut off a palm or two above the ground, and from these old root-stalks new plants put forth, which yield a second crop.⁴ Sometimes this operation is confined to cutting off the branches and leaving the main stalk; and again, when, on account of the labor of such work, it is regarded as tedious, the cattle are turned in and allowed to break the stalks at random by wandering through the field. The cutting away of the old stalk is generally done toward the close of the dry season. As the herbaceous varieties are all annuals, this operation is not performed upon them.

PICKING.

The time for picking, like that for planting, varies with the season, according as the winter is a long or a short one. It will be noticed in the replies to the circular that there is apparently great contradiction in regard to the time of the year in which picking is done. Even from one locality in the province of Pernambuco there are seven different periods given as the picking season. This is due to the fact that cotton is picked during and toward the close of the dry season. To express it in another manner, picking is done a certain length of time after the planting, and as the planting is done at the beginning of the winter, this season may be two or three months earlier or later in one part of the empire than in another. Even in places not far removed from each

¹ Major Taunay, in his *Tratado sobre o Algodoeiro* (pp. 33-35), very properly protests against this method of cultivation, and shows that it is impossible for a plant to derive the proper nourishment from such a hard soil.

² See *L'Univers: Brésil*, par Denis, p. 354.

³ *Roteiro do Brazil*, por Gabriel Soares de Souza. (*Revista do Inst. Hist. do Brazil*, 1851, p. 202).

⁴ This custom seems to be practiced in Minas Geraes. (See Aug. de Saint Hilaire's *Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, vol. II, p. 109.)

other there is frequently a marked difference.¹ Accordingly, therefore, picking may begin as early as June² (interior of Ceará) and ends in February, if not earlier. As a rule, however, very little cotton opens as early as June, even in the interior, while nearer the coast the bulk of it opens in November, December, and January.

The cotton ripening over so long a period, and the picking being continuous, has given rise to false impressions in regard to the number of crops yielded in a year. I have already referred to this error in another place,³ and shall only repeat here that there is but one crop, properly speaking, although this is gathered over a period varying from two to nine months.

The operation of picking an ordinary crop, when distributed over so long a space of time, does not require any particular system, and does not assume the importance of the pickings in the southern United States. Fields are never large, and cotton being cultivated, for the most part, on a small scale, picking is done more at the leisure and convenience of the planter. With the varieties of tree cotton there is but little risk of loss in leaving the ripe cotton in the bolls a few days longer than could be done with the herbaceous varieties, for the seed of the former being more compact, when they ripen, do not cause the fiber to thrust the mass in a loose flock from the boll, as is the case with the latter.

The cotton-pickers carry baskets or bags with them, in which the cotton is placed as it is gathered, very much as is the custom in this country.

One may sometimes, though rarely, see the bolls themselves broken from the plants, and afterward dried in the sun before the cotton is removed from them. M. Ferdinand Denis, speaking of the negro cotton-pickers, says in his *Histoire du Brésil*:⁴

Each one carries a basket holding about fifteen kilos of bolls; only three fingers should be used in picking,⁵ and care must be taken to break off the stalk without disturbing the tree. * * * After the bolls are picked, they are dried in the sun.

M. Auguste de Saint-Hilaire, in describing the method of picking cotton in Minas Geraes, says⁶ that the bolls are left to open, and the cotton is then removed without disturbing the pericarp. He does not approve of this method, owing to the injury done the cotton by dust and dew from

¹ Father Fonseca says that the tree cotton opens nine months after planting, while the herbaceous requires only six. (*Tratado sobre o Algodoeiro*, pelo Major Taunay, p. 52.)

² In his *Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, Auguste de Saint-Hilaire says that in Minas Geraes picking begins in May and ends in August. He adds, however, that it may be true that it is picked in some parts of the province in September or in October.

³ See p. 30.

⁴ *L'Univers: Brésil*, par Ferdinand Denis, p. 355.

⁵ It is evident from this reference to the use of the three fingers, that Mr. Denis has confused cotton-picking, as we understand it, with the gathering of the bolls.

⁶ *Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, par Aug. de Saint-Hilaire, vol. II, p. 109.

the time the bolls first begin to open until it is mature, and also to the loss caused by some of the fiber falling upon the ground. He therefore advises planters to cut off the bolls with scissors, as soon as they begin to open, and to dry them in the sun. But such a process has not been adopted by planters, although small lots are occasionally picked by gathering the bolls.¹ The soiled condition in which cotton is sometimes brought into market may possibly be explained by referring it to this method of picking.

GINNING.

What kind of a gin to use has been a question of importance among Brazilian planters. This question was not between various kinds of saw-gins, but between saw-gins and the old-fashioned way of cleaning cotton with two small wooden cylinders revolved close to each other.

The cotton factories of Manchester, England, found their supply of cotton of long fiber so impaired by the use of saw-gins in Brazil, that, in 1868, John Cheetham, M. P., president of the Cotton Supply Association, wrote the Brazilian minister at the court of St. James, requesting him to use all possible influence with the Imperial Government for the suppression of saw-gins. The following is Mr. Cheetham's letter, translated from the Portuguese:²

JUNE 16, 1868.

In the capacity of president of the Cotton Supply Association, and upon request, I inclose to your excellency a memorial, directed to the Brazilian Government, upon a subject of great importance to cotton culture in Brazil.

Formerly, after it was picked, cotton was cleaned by machines of primitive construction adapted to manual labor, but which performed the operation without injuring the fiber of the cotton; lately, however, machines have been imported from this country called saw-gins, which clean the cotton more rapidly, and consequently at a smaller cost, but which cut or ruin and render the fiber "neppy," as the consumers in this country say, thus lowering the value of the cotton from one to three pence per pound, according to the fineness of the fiber. In some cases the cotton can no longer be employed for the purposes to which it was formerly adapted, thus diminishing the consumption of Brazilian cotton in this country.

This state of affairs is much to be regretted, for Brazilian cotton is so well adapted to the manufactures of Great Britain that the Cotton Supply Association sees no reason why the present exportation of 500 bales per annum should not reach 1,000,000 if the saw-gins were done away with entirely and the Macarthy, or roller-gin, adopted.

Believing that the Brazilian Government will take the necessary means for remedying this evil complained of,

I have the honour to be, your excellency's obedient servant,

JOHN CHEETHAM.

SIR, BARON OF PENEDO.

The following is the translation of the memorial referred to by Mr. Cheetham in his letter:

OFFICE OF THE COTTON SUPPLY ASSOCIATION,

No. 1 Marriotts Court, Manchester, May 21, 1868.

SIR: The Cotton Supply Association desires to call the attention of your Government to the great injury from which Brazilian cotton is suffering on account of the

¹In Major Taunay's *Tratado sobre o Algodoeiro no Brazil*, pp. 62, 63, directions for picking tell how to remove the cotton with three fingers. There is no reference to cutting off the bolls.

²*Auxiliador da Industria Nacional*, 1868, p. 451.

use of the saw machine for ginning it and preparing it for the market. Formerly this cotton was highly esteemed by our manufacturers, and commanded a price almost equal to that of Egyptian cotton, but its fiber being of a length and quality that could not withstand the action of the saw-gin, it has deteriorated to such an extent by the continual use of this gin, that its value has fallen off considerably, and it is to-day regarded with growing disfavor.

The reason for which the saw-gin is used in preference to the Macarthy gin is due to the fact that the former can clean a greater quantity of cotton within a given time, but the apparent advantage is more than balanced by the injury done the value of cotton cleaned by the saw-gin as compared with that cleaned by the Macarthy, or roller-gin.

This difference in value has reached 2*d.* and even 4*d.* per pound, so that the manufacturers will not use cotton cleaned with the saw-gin as long as they can obtain Egyptian and other qualities of cotton which, while competing with the Brazilian, are cleaned almost altogether by the Macarthy gin, and are received for consumption in preference to the Brazilian.

No complaint is made against the method of cultivation, and doubtless the planters will obtain larger profits from their labor by abandoning this disapproved method of ginning cotton.

The Cotton Supply Association, therefore, urgently begs the Brazilian Government to employ without delay all possible means to diminish and remove an evil in so high a degree prejudicial to Brazil, and which will diminish a commerce of so much importance to the country.

This association has endeavored, by means of warnings through the press and by representations made to British consuls in Brazilian ports, to abate this evil; but not having attained its object so far, it respectfully solicits the prompt and efficacious aid of your Government in the conviction that unless a remedy is soon found, the mutual interests of this country and of Brazil will suffer serious injury.

We have the honor to be, your excellency's obedient servants,

JOHN CHEETHAM, *President.*

EDMOND ASHWORTH, *Vice-President.*

ISAACS WATTS, *Secretary.*

His Excellency the BARON OF PENEDO,
Brazilian Minister, London.

The importance attached to this question by the Manchester Association, and their efforts to suppress the saw-gins, appear to have been, for the most part, fruitless.

In 1871 the Sociedade Auxiliadora da Industria Nacional entertained the following question:¹ "What kind of cotton gins shall this society recommend—the saw-gins or the cylinder-gins?" A committee was appointed to report upon the question. The report of the committee contains² descriptions of the Macarthy gin, referred to and recommended by the Cotton Supply Association of Manchester, and also of the old *cherka* machines so long used in Brazil. Of the saw-gin the committee says³ that its use became common in Brazil during the civil war in the United States, when it was necessary to put into the market at once a large supply of cotton. It recommends that under normal conditions this gin should not be used, on account of its breaking the fiber, and

¹ *Auxiliador da Industria Nacional*, 1871, p. 70.

² *Auxiliador da Industria Nacional*, 1871, pp. 345 *et seq.*

³ *Auxiliador da Industria Nacional*, 1871, p. 349.

emphasizes its recommendations by quoting from a Report on Brazil at the Paris Exhibition, in 1867, II, p. 653, in which the author attributes the low price paid for Brazilian cotton to the use of saw-gins.¹

But in spite of all these efforts to suppress it, the saw-gin remains master of the situation, and nowadays it is very rarely that any other kind is seen, even in the remote interior.

The following description of this primitive machine, which is said to be preferable to the more rapid saw-gins, from Auguste de Saint-Hilaire, is faithful and sufficiently detailed:³

For separating the cotton from the seed a small portable machine is used, which is composed of two supports, upon which rest two cylinders about a foot long and the size of one's finger and close to each other. The cotton is fed on one side of these cylinders, while they are revolved in opposite directions by means of cranks extending beyond the supports. The cylinders pinch the cotton and draw it through to the other side of the machine, while the seed remains on the side where it was fed.⁴

The cylinders are made of hard wood. A single machine, turned by hand, cleans about fifteen pounds of cotton per day, employing two persons, one to turn and one to feed the cotton. In addition to the slowness with which cotton is cleaned upon one of these machines, not infrequently seeds are crushed and thus the cotton is soiled.

But as has already been remarked, such machines are now rare, and becoming more so. In every community in which cotton is grown there is at least one gin, the proprietor of which buys the unginned cotton from the planters and small farmers, cleans and bales it, and sends it to the market.⁵

In connection with these gins there are generally rude wooden baling presses, where the cotton is made into bales of about seventy-five kilos, sacked and bound with *sipós* (lianas), in which shape they are sent to the nearest market. The power used for baling is a large wooden screw, turned by hand.

The seed are turned to no especial account. In a very few instances where they have been near sea-ports they have been shipped to England or to Rio de Janeiro. Where steam engines are used as the motive power for the gins some of the seed are used for fuel, while the remainder is left to rot upon the ground or to be eaten by the cattle in the neighborhood. Occasionally they are used for manure.

HOME CONSUMPTION.

Owing to the ease with which it is produced, the extent of its culture, the difficulty of getting the raw material into the market from

¹The writer refers to the secretary of the Cotton Supply Association as his authority for these statements. (*Auxiliador da Industria Nacional*, 1871, p. 349.)

²*Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, vol. I, p. 406.

³The author adds that a similar machine is still in use in the Levant. (*Voyage dans les Provinces de Rio de Janeiro et de Minas Geraes*, vol. I, p. 406.)

⁴For another description of this machine, see *Travels in Brazil*, by Henry Koster, vol. II, pp. 170, 171.

⁵This seems to have been the custom for many years. Koster noted it in the north of Brazil in 1809-'15. (*Travels in Brazil*, vol. II, p. 169.)

remote points, the evenness and mildness of the temperature, which, as a rule, does not require the warmer clothing of a more rigorous climate, the number of domestic purposes for which it is used, and the high tariff upon foreign manufactured goods, the home consumption of cotton is very large and is rapidly increasing. A writer¹ upon the resources of Brazil in 1837 said: "Of the latter article [cotton] the immense quantity consumed in this country is scarcely credible." The same writer says² that the home manufacture and consumption of the province of Minas Geraes alone (about 1836) amounted to 5,800,000 yards of cotton cloth. These statements were made long before any cotton factories had been established in Brazil.

Pompeo de Souza estimates the home consumption in the province of Ceará (1858-'59) at 320,000 pounds per annum,³ which is about one-thirteenth part of the whole production.⁴ There was not at this time, and neither is there as yet, a single cotton factory in the province of Ceará, and it is to be supposed that the consumption is much larger, proportionately, in provinces containing spinning and weaving factories.

For more than two hundred years after the discovery of Brazil the cotton consumed in the country was manufactured in the most aboriginal manner. In 1785 (January 5) a decree from the king of Portugal, prohibiting the use of looms, except for the manufacture of the coarsest kind of cloth, revealed the fact that there were in Rio de Janeiro, at that time, only about twenty hand-loom, four or five of which were out of repair,⁵ and it is very probable that these were, with a very few exceptions,⁶ the only looms in the colony at the time. Under such restrictions it was impossible that any advance should be made in the manufacture of cotton for domestic purposes.

It is said that, owing to such violent measures affecting the manufacture of cloth, even those proprietors who were exempted under this decree were so fearful of gaining the hostility of the Government that they neither sought to increase their production nor to improve it, and that in many cases they gave up the business altogether.⁷

¹ J. J. Sturz's *Statistical Notes on Brazil*, p. 81.

² J. J. Sturz's *Statistical Notes on Brazil*, p. 111, foot-note.

³ The population of Ceará at this time, according to the same author, was 500,000. (*Ensaio Estatístico*, p. 296.)

⁴ *Ensaio Estatístico da Província de Ceará*, por Thomaz Pompeo de Souza. Brazil, p. 356. Pompeo gives the exports from Ceará for 1858-'59 as 125,000 arrobas, while the treasury department gives it as 74,324 arrobas. For remarks on discrepancy in statistics, see below.

⁵ *Revista do Instituto Historico do Brazil*, 1848, p. 232, et seq.

⁶ Varnhagem, in his *Historia do Brazil*, refers to a governor of Rio Negro, then a private government in the captaincy in the province of Pará, who, in 1799, died at Barcellos, where he had ruled for eleven years, and where he had encouraged, among other things, the manufacture of cotton cloth. (*Historia do Brazil*, II, p. 1070.)

⁷ *Auxiliador da Industria Nacional*, January, 1883, p. 6.

In 1808, however, the prince having arrived in Brazil, the decree prohibiting looms was revoked,¹ and the cotton industry of the country gradually recovered from the effects of the former decree.

The first regular cotton spinning and weaving factory was established in Pernambuco immediately after independence. The material was all prepared by hand, though but a few free operatives were employed. Some progress was made, however, and machinery was introduced and put to work. But being confined to slave labor the concern met with embarrassments, and disappeared entirely in 1834.²

In 1841 a factory was established in Rio de Janeiro, which, although it had the support of the Imperial Government, no longer existed in 1865. In 1851 a factory was started at Sorocába, in São Paulo, and in 1852 another began operations in Rio de Janeiro.

In 1866 a report upon the spinning and weaving factories existing in Brazil at that time gave the following information:³

Factories	9
Operatives.....	768
Spindles	14, 875
Looms	385
Cloth produced.....meters..	3, 944, 600
Thread	125, 600
Approximate value of products	2, 116, 200

The following table shows the number and capacity of the factories at the present writing. Three or four of these factories cannot properly be classed among the consumers of raw material, from the fact that they are merely weaving establishments, their thread being imported from England,⁴ under a discriminating tariff regulation. Some of them, however, are arranging to spin their own thread, and doubtless they will all within a short time become spinning as well as weaving factories.

There is also one knitting factory at Jacarehy, in the province of São Paulo, which imports its thread and which is not included in the list. It was established in 1879 by Luiz Simão and his brother, with a capital of 32,000 milreis, consumes 12,000 kilograms of thread annually, and employs 67 operatives.

¹ *Revista do Instituto Historico do Brazil*, 1848, p. 239.

² *Auxiliador da Industria Nacional*, January, 1883, p. 6.

³ *Diario Official*, Rio de Janeiro, March 13, 1883.

⁴ *The Rio News*, March 15, 1883, has the following: "There are at present 45 textile factories in Brazil. Many of these are only weaving factories, the prepared yarn being imported from England under special encouragement from the Government. By a strange inconsistency in the tariff these weaving establishments are so favored as to materially discriminate against others, which spin their own yarn from cotton grown in the country. The cause of this lies in the fact that the private interests of the protectionist leaders were bound up in the weaving instead of the spinning factories."

Itaboraí	Itaboraí	187 (?)	28	100,000	50	União Itabirana Co.
Sabará	Sabará	1882	25	136,000	61	Borges, Irmão & Co.
Montes Claros	Caçá	1882	24	210,000	100	Francisco Fernandes de Barros.
Uberaba	Salto	1875	50	140,000		Antônio Lemos da Fonseca.
Itu	Santo Antonio	1874	25	100,000		Stock company.
São José de Parahytinga.	Industrial Jundiabyana	1874	25	240,000	93	Diogo Antonio de Barros.
Jundiaby	Caxoeira do Votuzantim	1875-76	60	720,000		Souza Queiroz & Roaston.
Caxoeira do Votuzantim	Major Barros		24	450,000	180	Luiz Vincente de Souza Queiroz.
São Paulo.	São Luiz		100	800,000		Manoel José da Fonseca.
Itu	Piracicaba				124	Manoel Guedes Pinto de Mello.
Piracicaba	Sorocaba		40	144,000		União Mercantil.
Sorocaba	Tatubá		54	900,000	92	Antonio Valentim da Silva Barros, manager.
Tatubá	Fernão Velho	1857-'63	40	45,000		Cruz & Co.
Alagoas:	Magdalena	1874	20			
Macelo						
Pernambuco:						
Pernambuco						
Sergipe:						
Aracaju		1884				

¹ It is probable that at least two of these factories are merely projected and, as yet, have no real existence, for in the replies of the Bahia committee to the "quesitos parli mentares," it is stated that there are ten factories in the province, one of which has been closed for several months. This report is dated February 28, 1883. I saw the original at Bahia.

² This factory, the most important in the country, was destroyed by fire, December 21, 1883.

³ Thread imported.

⁴ Idle.

⁵ Idle; thread imported.

⁶ In 1881.

Of the forty-six establishments doing their own spinning, we have the consumption given for only twelve, the average for which is 174,360 kilograms per annum. As the larger factories are more likely to be known than the less important ones, this average is probably too high for the factories whose statistics are wanting, though the error is doubtless on the safe side in placing the average annual consumption of raw material for the remaining thirty-four that do their own spinning 170,000 kilos. This would give a total for the whole number, 7,872,320 kilos, or 17,319,100 pounds annually.

This industry is confined almost wholly to the provinces of Rio de Janeiro, Minas Geraes, São Paulo, and Bahia, where the demand for the better grades of coarse cotton cloth is greatest. But it has by no means done away with domestic consumption of the raw material. There is no more familiar sight to the traveler in the interior of Brazil than that of spinning with the ancient distaff and spindle.¹

In some parts of the country this custom is so common that the children learn it as a matter of course, and it would be difficult to find a person who does not know how to spin. Very nearly all the hammocks used throughout the northern part of Brazil, together with considerable quantities of coarse cloth, are made of thread spun in this manner.²

Pompeo's estimate of the home consumption in the province of Ceará is less than one pound (0.64 pound) of cotton for each inhabitant. However trustworthy this estimate may have been at the time (1860), the establishment of factories within the empire, and the low price at which foreign-made cotton goods may be bought, do away with the necessity of a large part of the direct domestic consumption nowadays. I believe it to be a very low estimate to assume that, outside of the provinces of Rio de Janeiro, Minas Geraes, São Paulo, and Bahia, which contain nearly all the cotton factories in the country, the present consumption of cotton is at least one-quarter of a pound for each inhabitant. The following table gives the population of these provinces³:

Provinces.	Population.	Provinces.	Population.
Amazonas	57, 610	Espirito Santo	82, 137
Pará	275, 237	Paraná	150, 000
Maranhão	359, 040	Santa Catharina	159, 802
Piauhý	202, 222	Rio Grande do Sul	434, 813
Ceará	721, 686	Goyaz	160, 395
Rio Grande do Norte	233, 979	Matto Grosso	60, 417
Parahýba	376, 226		
Pernambuco	851, 539	Total	4, 649, 346
Alagoás	348, 000	Or, in round numbers 4,650,000.	
Sergipe	176, 243		

¹ A spindle of this kind is figured by Thomas Ewbank, in Appendix A, p. 464, Fig. 1, of his *Life in Brazil*. This is an ancient specimen from the western coast of South America, but is the same as those used in Brazil nowadays, save that instead of being made of stone the shoulder or wheel is generally of wood.

² Mawe's *Travels in the Interior of Brazil* contains many references to the manufacture of coarse cotton cloth. (See pp. 96, 277, 302, 385 of 2d Eng. edition.)

³ From the *Atlas do Imperio do Brazil*, organizado por C. L. de Carvalho, Rio de Janeiro, 1832.

This would make the domestic consumption about 1,162,000 pounds, which, with the amount made up by the factories and used in the country, makes the whole consumption of raw material within the empire 18,481,600 pounds annually since the factories began operations,¹ an estimate which, while it is very unsatisfactory, is certainly well within the limits of the true amount.

EXPORTS. †

In connection with the subject of exportation, which must necessarily be confined for the most part to statistics, I am obliged, both as an apology for the incompleteness of the accompanying tables and as an explanation of inconsistencies which must appear when compared with various fragmentary tables of cotton exportation, to refer to the very unsatisfactory nature of the statistics which I have been compelled to use as the source of my information.

The most complete reports to be had of the exports of cotton from Brazil, and the ones generally accepted as the most trustworthy, are those accompanying the annual reports of the Minister of Finance. These statistics are taken from the reports of the custom-houses in the various shipping ports of the empire, and where such reports are wanting, or are incomplete, as they frequently are, they are filled out upon the basis of the reports of former years.

In the report of the department of finances for 1879 there is a note at the end of the table of exports to the following effect:

Some of the provinces did not send in their table of statistics, for which reason the principal articles of export cannot be given, they having been included under the head of various products.

In the report of 1882 a note at the end of the table of exports says:

The larger part of the custom-houses not having sent in their lists of exports, this table, in the absence of positive information, is constructed on the basis of the averages of the three years anterior to 1880-'81, and it may therefore undergo slight modifications, one way or the other, although unimportant ones.

The following instances, taken at random, show the character of the discrepancies to be expected in these statistics:

Year.	Whence exported.	Authority.	Quantity.	Differing from treasury report.
			Kilograms.	Kilograms.
1871-'72	Bahia	{ Treasury report	6, 679, 851	.....
		{ Dr. Nicolau Joaquim Moreira, Noticia sobre Agricultura, p. 34	6, 279, 851	*400, 000
		{ Official, from the Bahia Exchange	6, 270, 578	*409, 273
1873-'74	....do	{ Treasury report	1, 574, 410	.....
		{ Dr. Moreira in Agricultural Instructions, p. 52 ..	1, 574, 410	Same.
		{ Official, from the Bahia Exchange	1, 502, 212	*721, 198
1871-'72	Alagoas	{ Treasury report	12, 412, 801	.....
		{ Dr. Moreira, in Noticia sobre Agricultura, p. 31..	12, 181, 430	*231, 371
		{ Maceio custom-house report	12, 212, 463	*200, 33
		* Decrease.		

¹ On an average about 1872.

Year.	Whence exported.	Authority.	Quantity.	Differing from treasury report.
			<i>Kilograms.</i>	<i>Kilograms</i>
1873-'74	.....do	{ Treasury report.....	5,943,778	.....
		{ Dr. Moreira, in Agricultural Instructions	5,663,978	*279,800
		{ Maccio custom-house report.....	5,581,724	*362,054
1871-'72	São Paulo.....	{ Treasury report.....	15,176,333	.....
		{ Dr. Moreira, in Notícia, &c., p. 45 ..	9,401,300	*5,775,033
		{ Deputy Campo Salles, in speech of February 27, 1882, made in the São Paulo assembly.	10,204,600	*4,971,733
1874-'75	.....do	{ Treasury report	7,402,890	.....
		{ Dr. Moreira, in Agricultural Instructions, p. 65.	9,897,482	†2,494,592
		{ Deputy Campo Salles, speech of February 27, 1882.	6,127,150	*1,276,740
1859-'60	Ceará.....	{ Treasury report.....	1,163,715	.....
		{ Thomaz Pompeu de Souza, in Ensaio Estatist., p. 357.....	1,173,858	†10,140
1871-'72	Empire	{ Treasury report	83,543,317	.....
		{ Dr. Moreira, in Notícia sobre a Agricultura do Brazil, p. 12	53,585,838	*29,957,479
		{ Brazil at Vienna, 1873, p. 154	53,589,838	*29,953,479

* Decrease.

† Increase.

Pompeo de Souza, in writing his valuable statistical work upon the province of Ceará, in order to obtain the correct amount of cotton produced and exported, sent to each parish a table, which was to be filled out in detail, giving the number of cotton fields and the quantity of cotton produced.¹ The results obtained by him are in striking contrast with the official reports. For the year 1858-'59 his tables give the amount sent into market at 125,000 arrobas, even when omitting the production of several parishes from which he obtained no data, while the treasury report gives the exports as 74,324 arrobas, a discrepancy of about 51,000 arrobas, or 1,632,000 pounds, in the exports of the province of Ceará for one year alone.

Comte Charles d'Ursel, in his *Sud Amérique*, says² the exports of cotton from Brazil, in 1869, were 7,242,400 pounds, which fell to 488,400 pounds in 1873. The treasury reports, as seen in the accompanying tables, show them to have been 90,475,509 pounds in 1869, and 96,424,457 pounds in 1873, which is by no means as discouraging to Brazil as would appear from Comte d'Ursel's figures.

But errors of this character in statistics are not uncommon,³ and they are only referred to here for the reasons mentioned, and to show that while the figures given are the most trustworthy to be had, they are not to be relied upon implicitly. Owing to the incompleteness of the best tables that it is possible to compile previous to 1851 and since 1876, I have confined the statistics to the period included between those years.

¹ *Ensaio Estatístico*, por Pompeo de Souza, p. 355-356.

² *Sud Amérique*, par le Comte Charles d'Ursel, Paris, 1879, p. 105.

³ In speaking of the errors in the reports of the Associação Commercial of Rio de Janeiro for 1880, the *Rio News* of October 5, 1881, p. 4, says: "The errors are of such a character that they will deceive a majority of people, and will lead to others no less serious in character." (For other comments upon the untrustworthy character of published statistics, see *Rio News* of October 15, 1881, p. 4; May 5, 1882, p. 4; May 15, 1882, p. 3; May 24, 1882, p. 3; and December 5, 1882, p. 3.)

The total exports from the whole empire from 1851-'52 to 1875-'76, inclusive, as shown by these tables, is 1,532,272,075 pounds. For some of the provinces the tables are not complete for the whole period. If they are filled out on the basis of the exports during other years, and in about the same proportion as those of other provinces, we must add 163,032,000 pounds to this number, making the total 1,695,304,075 pounds for twenty-four years. To this add 27,900,000 pounds for the direct domestic consumption for twenty-four years,¹ and 69,276,400 pounds for the amount used by the factories² during the four years from 1872 to 1876 (for, as already shown, they had been in existence, on an average, only since 1872), and we have as the total production of cotton by the whole empire during the twenty-four years from 1851-'52 to 1875-'76, 1,792,480,000 pounds, or an average annual production of 74,686,700 pounds.

Exports from the Empire of Brazil by provinces.

[NOTE.—In reducing these tables from arrobas and kilograms to pounds, 32 pounds was taken as the equivalent of the arroba and 2.2 pounds as that of the kilogram.]

Years.	Pernambuco.	Alagôas.	Maranhão.	Parahyba.	Ceará.	São Paulo.	Bahia.*
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1851-'52...	5,831,584	4,482,240	.....	6,864,032	1,373,472	.....	1,912,800
1852-'53...	6,820,192	4,992,718	9,510,784	5,948,512	2,160,736	.....	2,214,752
1853-'54...	3,965,280	5,003,872	12,877,504	4,284,128	1,627,520	.....	468,448
1854-'55...	4,200,704	4,819,200	9,816,000	6,293,280	1,547,744	.....	761,344
1855-'56...	5,571,424	7,439,584	9,344,640	8,207,840	2,100,672	.....	1,473,312
1856-'57...	4,918,656	7,368,640	8,570,336	9,266,976	1,970,496	.....	2,004,800
1857-'58...	3,886,656	10,005,152	9,000,160	6,039,712	2,458,240	.....	597,472
1858-'59...	2,670,624	5,344,768	7,391,840	4,966,832	2,378,368	.....	299,552
1859-'60...	4,181,480	4,894,432	7,704,864	7,089,824	2,482,592	.....	296,928
1860-'61...	2,546,752	4,174,176	6,654,528	5,704,576	1,879,296	.....	37,120
1861-'62...	3,734,976	8,748,704	6,728,288	5,884,800	1,625,120	.....	519,776
1862-'63...	8,212,768	9,062,400	7,374,432	6,460,768	1,416,000	.....	1,466,048
1863-'64...	12,623,744	5,097,760	7,840,448	5,174,336	1,716,320	16,608	1,564,320
1864-'65...	19,939,744	11,263,904	7,975,872	7,935,360	3,075,680	20,224	2,094,656
1865-'66...	33,838,464	13,964,896	10,240,256	12,873,248	4,388,192	.....	7,232,192
1866-'67...	35,086,784	8,800,896	8,809,408	8,829,088	5,186,304	.....	7,553,600
1867-'68...	29,262,432	10,906,176	11,923,680	10,230,336	9,531,306	.....	14,216,416
1868-'69...	23,406,130	14,853,248	12,381,632	10,903,840	10,309,860	.....	5,824,160
1869-'70...	29,286,820	11,662,871	9,197,267	8,033,661	11,482,123	.....	5,892,799
1870-'71...	27,415,377	14,832,550	12,767,493	3,583,595	10,441,006	.....	6,942,478
1871-'72...	50,326,668	27,308,162	13,575,296	10,691,696	18,313,368	33,387,933	14,695,672
1872-'73...	33,547,648	10,768,397	8,323,473	6,069,074	10,934,141	16,152,622	3,255,701
1873-'74...	27,045,005	13,076,312	8,771,864	9,690,877	10,731,697	37,401,263	3,463,702
1874-'75...	24,524,645	11,359,935	8,544,492	12,996,265	12,623,798	16,286,358	1,084,120
1875-'76...	20,248,846	5,536,907	7,813,714	8,246,198	7,654,229	6,830,069	247,181
Total..	423,093,403	235,767,900	223,138,271	192,268,854	139,408,370	110,095,077	86,119,349

* Formerly one of Bahia's chief articles of export was cotton. Mawe wrote in 1810: "The main articles of produce are sugar, cotton, and tobacco. The annual exports of cotton may be stated at from 30,000 to 36,000 bags." (See *Travels in the Interior of Brazil*, by John Mawe, p. 468.) To-day Bahia imports cotton for her factories.

¹ This average, which is made upon the basis of the population as given in Carvalho's *Atlas do Imperio do Brazil*, is doubtless somewhat too large for the period referred to.

² A small error is caused by including in the exports cotton shipped from the northern ports to supply the factories in Bahia and Rio de Janeiro. This quantity, however, is not of sufficient importance to materially affect the results.

Exports from the Empire of Brazil by provinces—Continued.

Year.	Rio de Janeiro.	Rio Grande do Norte.	Sergipe.	Piauhý.	Pará.	Rio Grande do Sul.	Total for the empire.
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
1851-'52				99, 072	83, 968	6, 944	20, 654, 112
1852-'53		167, 308	1, 280		125, 856	10, 944	31, 953, 082
1853-'54	8, 544	60, 000		132, 384	124, 000	1, 120	28, 552, 800
1854-'55	1, 824	336, 544		198, 944	83, 168	10, 880	28, 069, 632
1855-'56		366, 432		225, 280	64, 448		34, 793, 632
1856-'57	1, 024	359, 328		258, 144	98, 400		34, 816, 800
1857-'58	64	223, 040		189, 312	65, 792		32, 465, 600
1858-'59		384, 256		515, 968	60, 992		24, 013, 200
1859-'60		387, 000		251, 360	56, 480		27, 344, 968
1860-'61		50, 048		352, 480	68, 576		21, 467, 552
1861-'62		128, 576		357, 024	111, 968	128	27, 839, 360
1862-'63	192, 256	176, 448	996	205, 952	156, 352		34, 724, 420
1863-'64	972, 864	782, 272		122, 240	178, 880		36, 089, 792
1864-'65	998, 432	1, 304, 864	4, 800	219, 648	388, 768	1, 024	55, 222, 976
1865-'66	6, 922, 336	2, 389, 216	289, 400	311, 168			92, 449, 368
1866-'67	5, 428, 320	1, 428, 384	620, 736	499, 872			82, 243, 392
1867-'68	12, 710, 464	3, 042, 351	152, 506	616, 672			102, 592, 339
1868-'69	9, 000, 736	2, 243, 564	988, 519	563, 820			90, 475, 509
1869-'70	2, 649, 931	2, 227, 025	1, 087, 792	593, 309			82, 113, 598
1870-'71	2, 530, 495	4, 410, 483	9, 692, 166	578, 565			93, 194, 298
1871-'72	6, 979, 564	5, 693, 961		636, 420		209	181, 608, 949
1872-'73	2, 825, 614	3, 708, 817		838, 662		308	96, 424, 457
1873-'74	1, 748, 032	4, 415, 884		373, 061			116, 717, 697
1874-'75	438, 643	4, 211, 552		709, 817			92, 779, 625
1875-'76	1, 916, 101	3, 683, 143		1, 488, 529			63, 664, 917
Total	55, 325, 244	42, 180, 504	12, 838, 195	10, 337, 703	1, 667, 648	31, 557	1, 532, 272, 075

C I R C U L A R .

Ministerio dos Negocios da Agricultura, Commercio e Obras Publicas—Directoria da Agricultura—1ª secção.

RIO DE JANEIRO, 10 de Abril de 1883.

O Governo dos Estados Unidos da America do Norte resolveu mandar proceder a estudos completos sobre o algodoeiro, suas especies, systema de cultura e colheita, producção e manufactura, qualidade dos terrenos e climas mais favoraveis, molestias e especialmente insectos que atacam a planta. Destes estudos no Brazil foram incumbidos o Dr. John C. Branner e o naturalista Alberto Koebele.

Sendo da maior conveniencia auxiliar tão importante trabalho, que pôde trazer ensinamento e indicações de summa utilidade para um dos principaes ramos da agricultura nacional, este ministerio confia no patriotismo das autoridades, das associações scientificas e industriaes, e dos agricultores e profissionaes a quem se dirigirem os ditos commissarios, hajam de responder com brevidade e precisão ao questionario por elles formulado, e prestar-lhes quaesquer outros esclarecimentos que possam aproveitar ás suas investigações.

O que particularmente recomendo a V. Ex. no interesse do serviço publico e dos melhoramentos agricolas.

Deus Guarde a V. Ex.,

HENRIQUE D'AVILA.

RIO DE JANEIRO, 10 de Abril de 1883.

Tendo sido encarregado pela Repartição da Agricultura do Governo dos Estados Unidos de estudar no Brazil as molestias e insectos que damnificam o algodoeiro, bem como outros assumptos relativos á cultura desta planta, e tendo concluidos os meus estudos, dirijo-me agora a diversas pessoas do paiz que me podem dar certas informações de que preciso para apresentar um relatorio mais satisfactorio e completo, incluindo outras observações além das que me foi possivel fazer no pouco tempo que tive a meu dispôr.

Por isso peço a V. Ex. que se digne responder ao questionario junto com a brevidade e exactidão possiveis.

E' desnecessario cuidar da forma da resposta, devendo porém dar com a resposta o numero da questão.

A resposta deve ser dirigida como vai abaixo indicado, e mandada pelo correio.

Espero que o meu trabalho será mais util á agricultura do paiz com essas informações, e confiando no patriotismo de V. Ex.,

Sou com toda a consideração.

De V. Ex., Attento Venerador e Criado Obrigado,

JOHN C. BRANNER,

Agente Especial da Repartição da Agricultura dos Estados Unidos.

Endereço:

JOHN C. BRANNER,

Department of Agriculture, Division of Entomology,

Washington, D. C., Estados Unidos.

QUESTIONARIO.

1. Desde quando o algodão foi plantado na sua provincia? (Indicando as auctoridades.)
2. Quaes são na Provincia de..... os principaes lugares que produzem algodão em maior quantidade?
3. Quaes os lugares que produzem a melhor qualidade?
4. Quantas qualidades de algodão se plantam, e quaes os nomes vulgares dessas qualidades?
5. Em que epocha do anno planta-se o algodão?
6. Por quantos annos as plantas produzem bom algodão?
7. Quantas colheitas dão por anno? Em que mezes são as colheitas?
8. Que descaroçadores usam, os de ferro e dentados, ou os de madeira?
9. As sementes têm algum proveito?
10. Usam de arados na cultura?
11. O algodão se planta em renques?
12. E' costume decotar as plantas?
13. Quando e como se faz o decote?
14. Ha alguma lagarta que fura as maçãs do algodoeiro?
15. Ha alguma lagarta que ataque e coma as folhas do algodão?
16. Em que mez apparecem essas lagartas?
17. Em que mez fazem os maiores estragos?
18. Que tempo dura a praga?
19. Quaes são as condições do tempo em que ellas apparecem em maior abundancia?
20. E' a chuva ou a secca que mais as favorece?
21. Atacam as plantas novas e velhas da mesma maneira ou têm alguma preferencia?
22. Apparecem em maior numero nos lugares seccos ou nos humidos? Nos altos ou baixos?
23. Em que anno, ou quaes os annos em que fizeram os maiores estragos na sua provincia e sua visinhança?
24. Que porcentagem julga que destruirão, termo medio?
25. Que porcentagem julga que destruirão nos annos em que causarão o maior damno?
26. Sabe si as mesmas lagartas que comem o algodão, comem alguma outra planta? Que planta ou plantas? (Dando os nomes vulgares, e quando fôr possivel os nomes scientificos.)
27. O que tem feito os plantadores para matar as lagartas ou para evitar o damno causado por ellas?

28. Conhece algum remedio efficaz ou meio preventivo, ou meios de diminuir os estragos feitos pelas lagartas?
29. Existe uma molestia da planta de algodão vulgarmente chamada “mofo”?
30. Este “mofo” ataca todos os pés, ou sómente alguns delles?
31. Apparece em maior quantidade nas plantas novas ou nas do segundo anno?
32. Apparece em maior quantidade nos terrenos altos ou nos baixos? Nos seccos ou nos humidos?
33. E’ opinião dos plantadores que esta molestia prejudica as plantas, ou diminue a producção de algodão nos pés atacados?
34. Conhece algum remedio ou meio preventivo?
35. Ha o que se chama “queima” ou “relampago” fazendo cahir as maçãs ou endurecendo-as ainda meio abertas?
36. Esta “queima” é a mesma nos terrenos seccos que nos humidos?
37. Como se explica esta “queima”?
38. Que remedio ou meio preventivo póde suggerir?
39. Destas pestes, qual é a que faz maior damno? A lagarta, o mofo ou a queima?
40. Qual é o embaraço mais serio á cultura de algodão na sua provincia?
41. Póde recommendar alguns meios para animar essa cultura?
42. Quantos kilos de algodão com semente é preciso para fazer 15 kilos em rama?
43. Existem algumas fabricas de tecer e fiar algodão na sua provincia? (Dando os nomes, e os lugares onde são estabelecidas.)
44. Quanto algodão em rama gasta cada uma destas fabricas por anno?
45. O algodão consumido pelas fabricas é produzido na vizinhança, na provincia, ou d’onde vem?
46. Plantam-se muitas laranjeiras?
47. Qual é o modo preferido para produzir plantas novas?
48. Quando plantam essas mudas, e como se tratam?
49. Ha alguma maneira de cultivar as laranjeiras, e qual é?
50. E’ melhor o terreno secco ou o humido?
51. As parasitas (vulgarmente conhecidas como “enxerto,” “enxerto de passarinho,” “hera de passarinho”) prejudicam as laranjeiras seriamente quando não são removidas?
52. Qual é a direcção geral dos ventos em cada mez do anno? (Si não puder dar para todos os mezes, dê para os mezes de Janeiro, Fevereiro, Março, Abril, Maio e Junho.)
53. Os gafanhotos tem causado algum damno ás plantações na sua provincia, e em que annos?

[Translation of the circular.]

C I R C U L A R .

Ministry of Agriculture, Commerce, and Public Works—Directory of Agriculture—First Section.

RIO DE JANEIRO, April 10, 1883.

The United States Government having determined to have complete studies made of the cotton plant, its species, system of cultivation and harvesting, its production and manufacture, the kinds of soil and climate most favorable to it, the diseases and especially the insects that attack it, John C. Brauner and the naturalist, Albert Koebele, have been charged with these investigations in Brazil.

As it is of the greatest convenience to aid so important a work, and one which may result in knowledge useful to one of the principal branches of our national industry, this ministry, trusting to the patriotism of the civil authorities, to the scientific and industrial associations, and to the planters and professional men to whom these gentlemen may address themselves, requests that they reply as early as possible, and

with precision, to the circular sent out by them, and that they give them whatever other information they may need in connection with their investigations.

This I especially recommend to you in the interest of the public service and of agricultural development.

God keep your Excellency,

HENRIQUE D'AVILA.

RIO DE JANEIRO, *April 10, 1883.*

Having been charged by the United States Department of Agriculture with the study of the diseases of, and the insects injurious to the cotton plant, and of other subjects connected with the cultivation of this plant in Brazil, and having finished my field-work, I now address myself to different persons throughout the Empire who may be able to give me information of which I stand in need, in order that I may be able to present a more satisfactory and complete report, including observations other than those which it has been possible for me to make within the short time at my disposal.

I therefore beg that you will kindly reply to the circular questions herewith as promptly and carefully as possible.

It is not necessary to take any particular pains about the form of the reply; each one, however, should be accompanied by the number of the question.

The answer to the circular should be sent by mail to the address given below.

Hoping, with such information as you may send me, that my labors may be the more useful to the agriculture of the country, and confiding in your patriotism,

I am, with all consideration, your Excellency's obedient servant,

JOHN C. BRANNER,

Special Agent of the United States Department of Agriculture.

Address:

JOHN C. BRANNER,

Department of Agriculture, Division of Entomology,

Washington, D. C., U. S. A.

CIRCULAR QUESTIONS.

1. Since when has cotton been planted in your province? (Giving your authority.)
2. Which are the principal places in the province of.....that produce most cotton?
3. Which places produce the best quality?
4. How many qualities of cotton are grown, and what are the common names of them?
5. What time of the year is cotton planted?
6. For how many years do the plants produce good cotton?
7. How many crops does the cotton yield in a year? In what months is it picked?
8. What kind of gins are used? Saw-toothed iron gins or wooden ones?
9. Is the seed put to any use?
10. Are plows used in its cultivation?
11. Is cotton planted in rows?
12. Is it the custom to prune the plants?
13. At what time of the year is this pruning done?
14. Is there a caterpillar that bores the cotton bolls?
15. Is there a caterpillar that eats the leaves of the plants?
16. In what month do these caterpillars make their appearance?
17. In what month do they cause most injury?
18. How long do they continue their ravages?
19. In what kind of weather do they appear in greatest numbers?
20. Is rain or dry weather more favorable to them?
21. Do they attack young and old plants alike, or have they some preference?

22. Do they appear more abundantly on moist or dry ground? On high or low ground?

23. In what year or years have these caterpillars done most injury in your province and in your neighborhood?

24. What percentage of the cotton, on an average, do you judge them to have destroyed?

25. What percentage do you judge them to have destroyed in the years when they did most injury to the crops?

26. Do you know whether the caterpillars that eat the cotton feed upon any other plant? What plant or plants? (Giving the common names, and, when it is possible, the botanical names.)

27. What have the planters done to destroy these caterpillars, or to prevent the injury caused by them?

28. Do you know of any trustworthy remedy or preventive measure, or way to diminish the losses caused by them?

29. Is there a disease of the cotton plant commonly called "mofo" (mold or mildew)?

30. Does this "mold" attack all the plants alike, or only part of them?

31. Does it appear mostly on the young plants or upon those two years old?

32. Does it appear to be more common on high or low, moist or dry ground?

33. Do the planters think that this "mold" injures the plants, or that it affects the yield of cotton in the plants attacked?

34. Do you know of any remedy or preventive measure?

35. Is there what is known as "queima" (burning) or "relampago" (lightning) causing the bolls to fall or hardening them while yet only half open?

36. Is this disease the same on dry and moist ground?

37. How is it accounted for?

38. What remedy or preventive can you suggest?

39. Which is the most injurious of these three pests, the caterpillar, "mold," or "burning"?

40. What is the most serious drawback to the cultivation of cotton in your province?

41. Can you recommend any measures for reviving this culture?

42. How many kilos of cotton with the seed are required to produce fifteen kilos of clean cotton?

43. Are there any spinning and weaving factories in your province? (Giving their names and those of the places where they are established.)

44. How much cotton does each of these factories use per annum?

45. Is the cotton used by them produced in the vicinity, in the province, or whence does it come?

46. Are many orange trees planted?

47. What is the method preferred for starting young plants?

48. When are these young plants put out, and how are they treated?

49. Is there any regular system of cultivating the orange trees, and what is it?

50. What kind of land is better for them, moist or dry?

51. Do the parasites commonly known as "enxerto" (graft), "enxerto de passarinho" (bird-graft), "herva de passarinho" (bird-grass), seriously injure the orange trees when not removed?

52. What is the general direction of the wind for each month of the year? (If it is not possible to give the direction for all the months, give it for the months of January, February, March, April, May, and June.)

53. Have the locusts ever caused any injury to the crops in your province; if so, in what years?

REPLIES TO CIRCULAR.

For the following answers to the circular (Nos. 1 and 3) I am indebted to Capt. Charles J. Storry, of Maranhão. Having been a resident of that place for a number of years and a sea-faring man, he vouches for the correctness of the answer to No. 52. The name of the author does not accompany the paper.

REPLY No. 1.

MARANHÃO, *June 28, 1883.*

1. I do not know, and I do not think it possible to find out exactly, when cotton was first planted in the province of Maranhão. Before it was cultivated on any considerable scale, however, it was grown in small quantities for making coarse cloth and was used as money.

2. Cotton grows well in all parts of the province of Maranhão; but it is grown in more considerable quantities in the municipalities of Codó and Alto Mearim.

3. The best grades come from the comarcas of Alcantara and São Bento.

4. Tree cotton is the kind generally planted, and that produces the best cotton; but various other kinds of "herbaceo" have been planted. In some years this "herbaceo" produces crops from four to six times as large as the tree cotton, while in other years it is ridiculously small, either on account of the damages done by the caterpillars, which greatly prefer it on account of its being more tender, and therefore injure or kill it, or on account of some atmospheric influence which has escaped my observation.

5. In Maranhão the tree cotton is planted from the latter part of December till the end of January, while the "herbaceo" is planted in March and April.

6. The tree cotton produces well for two years; in some localities the second year's crop being the larger one. If it is properly cared for, it will yield still longer, perhaps for six years. The herbaceous variety is an annual plant.

7. There is but one crop a year. The picking begins in August and ends in December.

8. Generally saw-toothed gins are used, rarely wooden ones.

9. For a few years past the seed that it has been possible to send to the market has been exported to foreign countries. The great bulk of it, however, is left upon the estates inland, which are far from the ports of exportation, while transportation is difficult.

10. As yet plows are not used here. Some of our planters who have introduced them have not succeeded with them; a fact due, perhaps, to the lack of proper agricultural instruction.

11. Cotton is not planted in rows, because the fields are strewn with logs, &c. Sometimes it is in rows, sometimes in triangles, just as it may be most conveniently planted.

12. It is the general custom to cut off or prune the cotton plants, both to make them branch out better and for the purpose of allowing clear space for the rice that is grown between the rows.

13. The best time for pruning is in April.

14. There is a caterpillar here that bores the cotton bolls, but it does no great injury.

15. There are also others that devour the leaves.

16. These caterpillars appear in January, and it would seem that they come out with the cotton. In the majority of cases they destroy the plantations, and it is necessary to replant the fields. They appear also in March, and sometimes in June, without anything to announce their coming other than the cessation of the rains.

Some think they are produced by the rankness of the cotton. It is true, too, that poor cotton does not suffer from the caterpillars.

17. They do their greatest damage in March, and if the short summer that produces and favors the caterpillars is prolonged they eat not only the leaves, but the tender twigs and even the bark.

18. They do not always last a fixed length of time, but depend upon the weather. Rain kills them.

19. It is when the rains are interrupted by several sunny days during the winter that these caterpillars appear in greatest numbers.

20. See the preceding answer.

21. They attack both, but seem to prefer the younger ones.

22. They do their greatest injury in low, moist land, though they always appear on high and dry land also.

23. There are no statistics on this subject.

24. For the same reason the exact average of the injury done by the caterpillars cannot be given. I believe I am not wrong, though, in affirming that they reduce the crop by one half when they appear in June, and when they appear in March and remain until April they reduce it to one-third.

25. See the above.

26. The cotton caterpillars eat no other plants, and it even seems that each plant has its own enemy.

27. The planters have done nothing to kill the caterpillars, either because they know of no agents to employ or on account of the difficulty of applying them on ground covered with trunks of trees, or in such large fields.

28. No remedy is known in Maranhão, and if the caterpillars have enemies they don't do the caterpillars much harm.

29. We have the disease called "mofo" here.

30. This disease attacks only a part of the plants, though sometimes a large part.

31. It attacks both young and old plants, but prefers the older ones.

32. It prefers low, damp lands.

33. It either kills the plant or weakens it so that it cannot yield fruit.

34. No remedy is known for it.

35. There is also the "queima," which causes the bolls to fall or hardens them before they open.

36. It is worse on dry lands.

37. The scientific explanation of this "queima" is not known. The common people attribute it to a kind of "spasm" caused by the rains during the heat of the day and after the sun has been shining brightly, and also to the eclipses.

38. No remedy is known and none can be suggested for this disease, which in a single day blasts the hopes of the planter.

39. Of these three pests the caterpillar is the most injurious and most certain; "queima" takes the second place.

40. The most serious drawback to the cultivation of cotton in the province of Maranhão is the depreciation of its market value, export duties, and the high price of freight in order to get it into the market. For these reasons it is impossible to compete with cotton grown in the United States where it pays no duties, is raised cheaply, and cheaply transported.

41. This branch of agriculture can only be encouraged by instruction, the use of the plow, cheap freights, cessation of imposts, and plenty of cheap labor. But inasmuch as the production is in excess of the consumption, as is now the case, depreciation follows, and brings with it discouragement and ruin to the planter.

42. Three kilos of cotton with the seed yield 1 of clean cotton or a very little less, or 48 kilos yield 15 clean.

43. There are no cotton factories in Maranhão.

46. But few orange trees are planted; not enough to supply home consumption.

47. They are planted in hills where they are to remain, the plants being reproduced from the seed or from grafts.

49. The seed are first planted in some small vessel, and after they have reached a certain size they are transplanted permanently.

50. Dry ground is better if it is not sand or "tabatinga" clay.

51. If the parasites are not removed, they prevent the trees from bearing fruit and afterwards kill them.

52. The direction of the winds is as follows: January, east-northeast, fresh. February, east-northeast, milder. March, east to north, light. April, east to northwest by north. May, variable. June, variable. July, east-northeast, moderate. April to July, calm weather. August, September, October, November, December, east-northeast, strong.

53. I cannot learn of locusts having caused any considerable damage to crops in this province of Maranhão.

From Dr. Antonio José de Amorim, Juiz de Direito.

REPLY NO. 2.

PENEDO, PROVINCE OF ALAGÔAS, May 15, 1883.

1. The exact date cannot be given, but the cultivation of cotton is very old. It reached its greatest development in 1864-'65.

2. The comarcas of Paulo Afonso and Traipú, in the southern part of the province. In Penedo, although but little is planted, it yields well, especially about São Braz, Porto Real do Collegio, and Igreja Nova.

3. The quality is generally the same. It differs only in cleanliness, which depends upon the care taken in picking it, both that it be gathered before the rains begin and that care be taken to keep it out of the dirt and from touching the dry, dead leaves.

4. Four, which are divided into two families, "criollo, quebradinho, herbaceo, and riqueza." That called "criollo" is a tolerably high bush, bearing a large boll, the staple being stiff, and the seed black and heavy. The "quebradinho" differs from the preceding only in that it has smaller bolls and seeds. The "herbaceo" is rich in staple, has a large, whitish seed, and differing from the kind known as "riqueza," which has a greater abundance of cotton, a larger boll, and a larger and bluish seed.

5. After the first rains, generally in February and March.

6. "Criollo" four years, "quebradinho" two or three, "herbaceo" and "riqueza" one year.

7. "Criollo" and "quebradinho" yield one crop a year; "herbaceo" and "riqueza" yield two, and are picked earlier.

8. The iron-toothed saw-gins, the American machines driven by steam being preferred.

9. The seed is used for fuel for the engines, for feeding cattle, and it is also exported to Rio de Janeiro and to England. I do not know what use is made of it in Europe, but in Rio an oil is extracted from it.

10. Plows are not used. Cultivation is all done with hoes.

11. It is planted in rows, and sometimes among other plants, such as corn, which protect it while it is young.

12. The plants are never pruned.

14. No.

15. Yes.

16. In the early part of winter. If the first rains are followed regularly by others, the caterpillars that appear with the first rains disappear before they have done any great injury; but if there should be any intermission in the rains, the caterpillars are developed in large numbers.

17. In May and June—the early part of winter.

18. From two weeks to a month unless there is a rain.

21. They attack all alike. It is noticeable, however, that in the old plants they can only destroy the leaves, while in the young ones they destroy them entirely. The old plants may therefore put forth new foliage, while the young ones die.

22. They seem to prefer the high and dry ground.

23. In 1879 and 1880.

24. Two-thirds of the crop.

25. There are cases of total loss of the crop during the present year and of two-thirds for previous years.

26. The common caterpillar eats the leaves of cotton, corn, beans, &c., indiscriminately. There is, however, a kind of caterpillar, commonly called “*rosca*,” which destroys the plants indiscriminately, eating the leaves and then damaging the stems.

27. No means have been found either to destroy them or to prevent their appearance.

28. No.

29. Yes.

30. The oldest plants.

31. We know of no instance in which they have attacked the young plants.

32. No observations have been made to this end.

33. It does injure the plants.

34. No.

35. Yes.

36. Yes.

37. Nothing is known positively in regard to its origin. It is observed to be most common, however, during the season of the year in which the sun shines very hot and there is much rain accompanied by thunder and northeast winds.

38. None.

39. The caterpillar.

40. The caterpillar.

41. No.

42. Of the kind known as “*herbaceo*” 48 kilos yield 15 kilos of clean cotton; of the “*quebrado*,” 53 to 55.

43. One in the suburbs of Maceio, the capital of this province.

45. The cotton used is from this same province, though but little is used; the rest is exported.

46. Yes.

47. The branches or shoots from the trees are transplanted.

48. The young plants, whether they are obtained from the seed directly or from the branches of the old trees, are set out to good advantage during the months of May and June—the rainy season. If there is not much rain, the plants have to be watered until they begin to grow.

50. Moist.

51. These parasites do great injury, and should be removed at once.

52. The winds of January vary according to the rains, from the northeast and southeast. In February and March they are the same; in April, from the west, south, and southwest until August; September and to December, from the northeast, and from the west if there are rains.

53. None.

The following answers were sent me through Capt. Charles J. Storry, of Maranhão. The name of the author, who is a planter, was not given.

REPLY No. 3.

MARANHAO, *June 28, 1883.*

1. It is not known who first planted cotton in this province. There is no tradition upon this subject and no trustworthy documentary evidence.
2. It is grown in the comarcas of Codó, Caxias, Alto Mearim, Alcantara, &c.
3. All the interior of the province of Maranhão grows cotton well, though the best quality comes from the comarca of Alcantara.
4. Three kinds are grown—viz., tree cotton, herbaceous cotton, and a yellow cotton commonly known by the name of “algodoí.” This last is grown only in small quantities.
5. It is planted from December 15 to January 15.
6. The cotton plant is a very strong one in this province, and if it were properly treated I believe that it would produce cotton for a great many years.
7. There is but one crop a year, which is picked from August till the end of November.
8. Saw-toothed gins are generally used.
9. Cotton seed is now exported abroad. Here in the country it is used only for manure for bananas or tobacco.
10. Attempts have been made in this province to use the plow for the cultivation of cotton; but either on account of a want of experience or through a lack of method in its use we have gone on in the same old way.
11. Some planters plant in rows.
12. Cotton is not pruned here.
13. See above.
14. We know of no caterpillar that bores the bolls.
15. The caterpillars that devour the cotton leaves are the greatest evil that persecutes us, and the one that does us most injury. In three or four days these terrible creatures will devour a whole field of cotton, eating all the leaves and sometimes the very branches themselves.
16. They make their appearance at the beginning of winter; it may be in November or in the latter part of winter, in the month of May, or they may even come in the midst of winter.
17. They generally do their greatest injury in the beginning of winter.
18. This plague lasts but a few days—from fifteen to twenty.
19. The conditions most favorable to the appearance are as follows: light rains followed by very hot sunshine, and then a suspension of the rains in the winter time.
20. See the above.
21. The caterpillars prefer the young plants.
22. They seem to prefer high, dry grounds.
23. There are no trustworthy statistics on this subject.
24. Not known.
26. It is beyond doubt that the caterpillars that eat cotton eat no other plant.
27. Nothing has been done to remedy the evil.
28. See above.
29. Yes.
30. This “mofo” only attacks a small part of the cotton plants.
31. It prefers moist, low grounds and plants two years old.
32. Moist, low lands.
33. It weakens the plants, turns their leaves yellow, and the few bolls produced by them are small.
34. No remedy or preventive is known.

35. We are not acquainted with a cotton disease called "queima" or "relampago."
39. The caterpillar is the worst plague.
40. In view of the crisis through which we are passing now, with the disappearance of slavery, our greatest impediment is the lack of labor, a serious matter, and one of difficult solution.
41. Immigration here is a mere dream. Foreigners are afraid of our climate and the diseases peculiar to a moist and hot soil. Our only hope is to establish the liberated slaves in colonies.
42. Forty-five kilos in seed yield 15 clean.
43. There is not a single cotton factory in this province.
44. See the above reply.
46. Very few oranges are planted in this province.
47. Generally from the seed.
48. They are planted in the winter, or are watered during the summer until they are strong.
49. We know of no cultivation.
51. The parasite that injures orange trees is commonly known here by the name of "tenten."
52. During the winter the winds vary much. In January, February, March, April, May, and June they are for the most part from the east and from the south.
53. We cannot learn of locusts ever having done any injury here.

From João de Mello Azevedo.

REPLY NO. 4.

MOGEIRO, PROVINCE OF PARAHYBA, July 2, 1833.

1. Not known.
2. Good cotton is grown in all parts of this province beyond twelve leagues from the capital.
4. The kinds planted are called crioulo, quebradinho, caroço verde or green seed, and herbaceo.
5. Planting is generally done in February, March, April, and May.
6. Crioulo and quebradinho yield for two years, the other kinds only one.
7. But one crop a year.
8. Saw-toothed gins and also wooden ones are used.
9. The seed is used to feed cattle.
10. Plows are not used in agriculture here.
11. Yes.
12. Yes.
13. Pruning is done close to the main stalk of the plant about planting time.
14. Some years the foxes destroy the bolls, but there are no caterpillars that injure them.
15. Almost every year the caterpillars attack the cotton so seriously as to put a crop out of the question if it is not replanted two or three times. In such years the crop is always poor.
16. Their appearance during the winter is never at any fixed time.
17. See No. 16.
18. They last from one to two months and more.
19. During the winter.
20. When they appear with the rain the dry weather favors them.
21. Some years they prefer the new, sometimes the older.

22. In high and low ground alike, though in some years with more virulence.
23. Not known.
25. About one-half the crop.
26. The caterpillars that eat cotton eat no other kind of plants.
27. No remedy known.
29. Yes.
30. It does not attack all the plants, though it injures a great many of them.
31. On old and young plants alike, and preferring the moist grounds. We also have another pest here, known as "rolla," which is a white grub that attacks the roots of the cotton plants and does great damage.
32. See the above.
33. It doubtless does great injury.
34. No remedy known.
35. This disease exists, but does not appear every year.
36. The same on wet or dry land.
37. The cause of this disease is not known.
38. No remedy is known.
39. The caterpillar is the worst of all.
40. Here we are 31 leagues from the capital of the province and upon excellent lands for agriculture. These lands are used for pasturing cattle, and as there is but little wood with which fences can be made, our little agriculture is very much burdened and the poor very much oppressed.
42. Forty-five kilos.
43. There is not a single cotton factory in this province.
47. Very few oranges are planted.
48. By planting the seed.
49. They are planted where the tree is to remain.
50. Moist land is better.
51. Unless these parasites are removed they kill the trees.
52. In January, February, March, April, and May the winds are from the east.
53. Locusts have done no damage in this province.

From Antonio José Gonçalves Pires Ferriera, planter.

For the following replies from Panellas, in the interior of the province of Pernambuco, and one of the places often referred to as being a good cotton-growing part of that province, I am indebted to the Juiz de Direito, Dr. Joaquim Aires d'Abreu de Freitas.

REPLY NO. 5.

PANELLAS, PROVINCE OF PERNAMBUCO, *June 10, 1883.*

2. The best cotton of this province is grown in the interior.
4. Crioulo, which has the seeds fastened together securely, quebradinho, carra-picho, verdão, albaço, and a small amount of yellow cotton.
5. At the beginning of winter, according to the beginning of the rainy season.
6. The production is for two years, but if the plants are properly cared for and cultivated they yield for three and four years.
7. There is but one picking each year, which is in the beginning of summer.
8. Saw-toothed gins driven by water, steam, or animal power, or by hand.
9. The seed is thrown away, serving to some extent to feed cattle and sheep.
10. Plows are not used, because the people are not accustomed to them, and in some places because the land will not admit of their use.

11. Planted in rows of hills about half a fathom apart.
12. The plants are cut off when the land is wanted for other purposes.
13. This is done with bill-hooks in the beginning of winter.
14. There are no caterpillars that bore the cotton bolls here. There are many birds, however, of the parrot family which eat the young bolls.
15. The cotton plants are attacked by caterpillars that eat the leaves and even the tender young branches.
16. They appear with the sunny days of the rainy season.
17. This depends on the season.
18. They last from two to three months.
19. They generally appear during the less rainy months.
20. After they have appeared, the dry weather.
21. They attack all kinds alike, only that with the old plants the large parts of the stalks are not injured.
22. No difference in regard to land.
23. They come every year, though they are worse in some than in others.
24. When the loss is small it is about 25 per cent.
25. When they are worst the loss is almost 100 per cent.
26. The same ones destroy the grasses of the pasture lands also.
27. Planters have never discovered any remedy for them further than to allow them to die when their time comes.
28. No remedy known.
29. The "mofo," or mildew, exists here.
30. This disease attacks almost all the plants, only a few of them escaping.
31. It attacks both old and young plants, though those of the second year suffer most.
32. It makes no difference in regard to soil.
33. Those plants which are attacked yield little or nothing.
34. No remedy or preventive is known.
35. This "queima," or "lightning," not only causes the bolls to fall to the ground, but causes the remaining ones to harden and remain unopened.
36. The plants on dry ground.
37. This burning is the result of heavy rains that fall upon very hot days while the ground is hot, and it seems that the roots of the plants are scalded.
38. No remedy is known.
39. This "queima" seems to be the worst.
40. Besides the evils above referred to, there is no serious attention given to cotton culture and no advancement made in it.
41. To encourage its cultivation, we should have the proper kinds of tools, agricultural banks, easy transportation, and the serious attention of the government.
42. From forty-five to fifty kilos of cotton with the seed yield fifteen kilos of clean cotton.
43. There is one factory in the city of Pernambuco.
46. Some oranges are planted, although it cannot be said that there is any cultivation of them.
47. New plants are obtained directly from the seeds, and also from grafts.
48. The seed are planted in beds of earth that have a little manure mixed with them.
49. Only as above mentioned.
50. Moist lands produce more and better fruit.
51. These parasitic plants attack orange trees seriously, and unless removed kill the trees.
52. Don't know.
53. The locusts do not often appear; when they do they don't do any great injury, and this little is on the grass of pasture lands.

From Commendador Francisco Benicio das Chagas, planter.

REPLY NO. 6.

ENGENHO BARRA NOVA,

Bonito, Province of Pernambuco, June 19, 1883.

1. According to General Abren e Lima, cotton was planted in this province by the Indians before the discovery of Brazil in 1500. A more trustworthy opinion, however, is that the cultivation of this plant began to be appreciated after the invasion of the Dutch. In this municipality it was begun by a Portuguese, named Joaquim Rodrigues Chaves, and some Indians, in the year 1808.

2. Pajeú de Flores, Cimbres, Buique, Bom-Conselho, Caruarú, Brejo, Bonito, Limoeiro, Bom Jardim, and Jacarará.

3. Pajeú, Bom Conselho, Cimbres, and Buique.

4. Crioulo, quebradinho, caiano, and herbáceo.

5. In the first part of winter, generally in January, February, March, and April, and always before the heavy rains.

6. This depends on the care taken of the plants and upon the fertility of the soil.

7. Cotton is picked from October to December, according to the abundance of the harvest and the weather.

8. English and American gins are used, driven by steam, animal, or water power.

9. The seed is used as fuel in the sugar factories and in the steamers for driving machinery, for food for cattle, and, when decayed, for manure.

10. Hoes are used, and not plows.

11. It is planted in rows as far as permitted by stones and other such obstacles.

12. That depends upon the ground; in some it is well to prune the plants, while in others it would kill them.

13. After the cotton is picked the plants are cut with a bill-hook, about a meter from the ground.

14. Yes.

15. Yes; these caterpillars appear every year. Some years they eat up not only the leaves, but also the tender young branches, in this way injuring the crop and causing the branches of the plants to dry up.

16. They almost always appear in the months of April and May, according to the amount of fair weather in those months.

17. In May, almost always.

18. Generally as long as the leaves last, which is about three weeks, for when the plantations are large the insects come in proportionally large numbers.

19. They are indifferent as long as they are able to eat up the crop.

20. It may be either, but the dry weather by preference.

21. The younger plants are the ones that suffer more.

22. There is no difference.

23. There is no year in which there is not an almost general destruction of the leaves of the cotton plants.

24. On an average, a third of the crop.

25. One-third of the crop, on an average.

26. It is the general opinion that when these caterpillars have finished their mission of devastation they descend from the plants and die. Sometimes the surface of the ground is rendered filthy by the odor exhaled by these dead insects.

27. Nothing but swear at them.

28. No remedy is known, so far.

29. There is here a kind of microscopic whitish parasite, which attacks the cotton plant and weakens it.

30. Especially upon old plants in land long cultivated.

31. It makes no difference.

32. The same.

33. The crop is diminished about 20 per cent.

34. No remedy has been tried.
35. Yes; it causes the bolls to fall, and wilts the leaves.
36. Mostly in high, windy places.
37. There is a diversity of opinion in this respect. Some think it is caused by the wind, others by lightning, and others by rain falling about noon. This last is most generally received.
38. Nothing but to lament one's losses.
39. This depends on the development of each pest during each year.
40. They are the above-mentioned evils, and also the great distance to the market, and a want of good roads. There are places so far removed that when the cotton arrives at the market in the city of Pernambuco, it takes one bale of cotton to pay the freight on the other.
41. See the reply above.
42. Sixty kilos with seed yield from 15 to 20 kilos of clean cotton. This, however, depends on the quality of the cotton; "herbaceo" being the kind that produces most.
43. There is one factory in the city of Pernambuco, belonging to a company whose manager is Commendador Antonio Valentim da Silva Barroso.
45. Mostly in this province, though some of it comes from the province of Parahyba.
46. A great many oranges are grown in this province. The principal places where they are grown are in the suburbs of the city of Pernambuco, in Santo Antônio, Bonito, and Taquaretinga.
47. The seeds are planted first in hot-beds or in small earthen or tin vessels. When the plants are from 16 to 32 inches high they are transplanted.
48. At the entrance of winter the ground is cleaned of bushes, and kept so during the summer.
49. In this province the hoe is used to clean about the trees; the dead limbs are kept cut off, and the parasitic plants are removed.
50. Medium and always sandy soil.
51. These parasites do great injury to the trees.
52. In the comarcas of Bonito, Bezerros, Caruarú, São Bento, and Altinho the southwest winds prevail from October till March. From April till June west winds prevail, though at times they may come from the east. These latter, however, are impeded by the serra of Bonitinho and by that of Burra, which runs east and west parallel to the first. Some of these winds are so strong that they uproot large trees and blow down the fields of corn.
53. Some have appeared here in passing by, but without stopping, while those to be seen here are not of the kinds that do such injury to crops.

From Antonio Severiano Bastos, planter.

REPLY NO. 7.

VILLA DE IMPERATRIZ, PROVINCE OF CEARÁ, June 11, 1883.

1. There are four kinds of cotton cultivated here, viz: "Quebradinho," "inteiro," white "herbaceo," and dark "herbaceo." The kind called inteiro is very ancient; the "quebr adinho" has been cultivated here since 1830, and the last two kinds since 1862.
2. In the mountains the "inteiro" and "quebradinho" are the kinds raised, while the low sandy lands produce the varieties of "herbaceo."
3. The best qualities are grown on sandy and white clay soils.
4. The four referred to in No. 1.
5. The "inteiro" is planted from December to February, "quebradinho" till May, while the "herbaceo," on account of its being of quicker growth, may be planted at any time up to the end of the rainy season.
6. The "inteiro" and "quebradinho" produce from one to three years, dark "herbaceo" for two, and white "herbaceo" for one year.

7. Picking begins in June and continues until January of the following year, so that it is picked all through the summer.

8. Saw-toothed gins, driven by ox-power, are used. Formerly wooden gins were used, and the staple was better than that obtained nowadays with the saw-gins.

9. The seed is used to feed cattle, and is as good as corn for this purpose. It also makes an excellent manure on lands to be planted in cane or tobacco.

10. Plows are not used.

11. No.

12. No.

14. There is no caterpillar that bores the bolls.

15. Yes.

16. In March, April, and May.

17. When they appear in May they do more damage.

18. From one to two weeks.

19. In March and April.

20. Rain is more favorable.

21. They attack all alike, but do most injury to the young plants, almost killing them.

22. No difference in locality.

23. Since 1860 this plague has been very regular, always doing more or less injury.

25. A very considerable damage, even to the point of disturbing business and influencing the price of produce.

26. The caterpillar that destroys the cotton does not injure other plants, so that it seems to come from the nature of the cotton itself.

27. Nothing.

28. No.

29. The "mofo" exists here.

30. It is never general, but attacks only a part of the plants.

31. No difference.

32. No difference.

33. Yes.

34. No remedy known.

35. The "queima" turns the leaves red and causes the bolls to fall off.

36. It is more common on dry lands.

37. It is caused by sudden rains and strong winds.

38. No remedy is known. It should be observed, however, that the following year, as soon as it rains, the plants that were injured by the "queima" produce as well as if they had not been attacked.

39. They are about alike, varying each one with the violence of the attack.

40. As a rule all the land here yields good cotton; so that the principal obstruction is the lack of capital and labor.

42. Of the variety "inteiro," sixty-two kilos; dark "herbaceo," sixty-two kilos; "quebradinho," fifty-six; white "herbaceo," fifty kilos yield fifteen kilos of clean cotton.

43. One is being built in the capital of the province.

46. Yes.

47. The seed are planted in a bed, and after the young plants have a good start they are transplanted.

48. The seed may be planted at any time; the young plants are removed during the winter.

49. No.

50. Moist.

51. Orange trees and all other kinds of plants.

52. The strong winds are from the east.

53. There have been locusts, but their injury was not serious.

From Dr. F. M. Draenert, Director of the Imperial School of Agriculture at Bahia.

REPLY NO. 8.

IMPERIAL ESCOLA AGRICOLA DA BAHIA,
Province of Bahia, June 3, 1883.

DEAR SIR: After having received your kind letter of March 31, and the "questionario," with your circular and that of the Brazilian Minister of Agriculture, and knowing by personal inspection of no place in this province of Bahia where cotton culture is carried on, I looked for information from our neighbor province of Sergipe, from whence I have received some by the intervention of one of my scholars. Here-with you will find such information, with my corrections and annotations, that is, a copy of the original. * * * I am now collecting you the information requested in regard to cotton culture and manufacturing in this province, and as soon as obtained I shall send it to you.

I am, dear sir, yours, very respectfully,

DR. F. M. DRAENERT.

JOHN C. BRANNER,
Washington, D. C.

From Dr. Leandro Ribeiro de Siqueira Maceiel.

1. For a long time cotton has been planted in Itabaiana, Nossa Senhora das Dores, and Propriás. During the civil war in the United States this industry was much increased and carried on upon a large scale, not only in the places referred to but in many other parts of the province of Sergipe. When prices went down this feverish enthusiasm died out to a great extent, and the planters of the province of Sergipe returned to their old industry of cultivating sugar-cane.

2 and 3. The localities which produce the best cotton, both in regard to quality and the facility with which it is grown, are the three above mentioned, which supply the small amount that is still exported.

4. A great many kinds of cotton are known, but the kinds preferred in Sergipe are the "herbaceo" (*Gossypium herbaceum*), and the "quebradinho;" the first mentioned yielding a greater abundance of cotton, and the latter less, but of a better quality.

5. The planting is always done during the first rains in April and May, when the rainy season sets in.

6 and 7. When the weather is favorable, the "herbaceo" barely yields a second year, and then dies out. The quebradinho, however, produces and always with advantage. It is hard to pick.

8. American gins of different types, driven by steam or animal power.

9. The seed is used as fuel for the motors, and food for cattle. In places easy of access a little has been bought for exportation, but the amount exported has been extremely small.

10. Cultivation is carried on with the hoe alone and not with the plow. The reason for this is that new ground is preferred on account of the ease of cleaning it, and also because the delicacy of the plant could not endure the severity of the plow, which is still so behind hand with us.

11. Cotton is planted in rows.

12, 13. With the "quebradinho", pruning or cutting away the old stalks at the beginning of the rainy season (in April) is very advantageous; but, owing to its being a tiresome, expensive, and inconvenient work, but few persons do it.

14. When the caterpillars come late in the season and find the bolls small and tender, they devour them entirely, clearing out things until it looks as if nothing had been planted there. This lasts only about two weeks.

15. Almost invariably the first plants are devoured by the caterpillars. In some years they eat even the branches, while in others they are less voracious. Their appearance is so certain that nowadays the planting is not done until after they have come and gone, which they do with the early rains (April). They seldom reappear in the same year, and when they do appear a second time they do but little injury. Aside from this, cotton planted early is twice as valuable as that planted after the caterpillars have gone.

16, 17, 18, and 19, answered.

20. Much rain or much sunshine are the most effective remedies.

21. They attack the old and second year plants also, but the damage done them is nothing in comparison to what they do the new plants.

22. They attack high and low ground and the dry and damp places alike, and in such a manner that they destroy in a single night the labor of many days.

23. When the winter begins dry is when they do the greatest harm, and there has not been a year in which they have not visited us. The remedy discovered so far is to do the planting "after the caterpillars," as the saying is, so sure is their appearance.

24, 25. Some years the destruction is complete—not leaving anything of the first planting. In other years they attack the plants, but the destruction is only partial.

26. This caterpillar is peculiar to the cotton plant, and does not eat anything else, either corn, beans, or tobacco.

27, 28. When they attack a field, there is no way of holding them in check. They finish it. Although they are so small, they make such a noise that one can hear them at their work of destruction at a considerable distance. Different attempts have been made to stop their progress by clearing away with the hoe in front of them, leaving the ground very clean, but all to no effect. Many of the planters have planted again behind them, and with good results, for they never turn back in their march.

29, 30. This "mofo", mold, or mildew, exists here, but the damage caused by it is insignificant, because it attacks only a few of the plants, or parts of fields, principally the old stalks of the kind called "quebradinho," whose yield it diminishes. Its injuries are common alike to high or low ground.

31-33, answered.

35. We have also the "queima," which attacks plants that are very rank. It is during the severe or very wet winters that this "queima" is most common. It reduces the crop considerably both by causing the bolls to fall and by causing them to harden when they are only half open.

36. It is most frequent on low, moist lands.

38. No remedy has been tried.

39. In comparison with the caterpillars the other diseases are as nothing.

40. The scarcity of laborers and the low price of cotton are the greatest obstacles to cotton culture. The low price since the war in the United States has caused many of the planters to abandon it. It will not pay labor fifty cents a day.

42. Forty-five kilos of "herbaceo" and fifty-two to fifty-five of "quebradinho" give 15 kilos of clean cotton.

43. The first cotton factory in this province is now being put up in Aracajú, the capital of Sergipe.

From the Baron of Serro.

REPLY NO. 9.

SERRO, PROVINCE OF MINAS GERAES, May 18, 1883.

1. Cotton has been planted in this province since the beginning of the last century.
2. It is cultivated on a large scale in Santa Rita do Turvo, Minas Novas, and Cipó.
3. The best kinds come from Cipó and Minas Novas.

4. Several kinds are planted, but that with the large boll is preferred. The names I don't know.
5. The principal planting takes place about the end of September.
6. For four years.
7. There is but one crop, but this is picked from the 1st of July till the middle of September.
8. The iron-toothed gins.
9. No.
10. No.
11. It is planted in hills.
12. As soon as the plant is a palm and a half in height the top of the central stalk is cut off. This is called "castration." After the cotton has been picked, the plants are cut off two palms above the ground.
14. Yes.
15. Yes.
16. In January and February.
17. In these same months.
18. Two months.
19. In rainy weather.
20. The rains bring them out.
21. They prefer the young plants.
22. They appear in greater numbers in low, damp places.
23. There are no data for an answer to this.
26. These caterpillars eat the blades of the corn also.
27. Planters have done nothing to destroy these caterpillars. They leave them for a black bird, known here as "arranca-milho" (corn-puller).
28. None known.
29. This disease, called "mofo," exists among our plants.
30. It attacks all the plants.
31. It shows no preference in regard to age.
32. In the low, damp ground.
33. It is the general opinion of planters that this disease injures the plants greatly and causes a very marked falling off in the yield.
34. No remedy is known.
35. Yes.
36. No difference is noted.
37. Our planters say that it is connected in some way with the eclipses of the moon.
38. There is no remedy.
39. The one called "queima" or "relampago."
40. The lack of laborers and of roadways.
41. Colonization and good roads to the sea coast. This is in reference to this part of the province.
42. Sixty.
43. There are several: Curvello, Taboleiro Grande, Beriberý, Itabira, Montes Claros, Sabará, Bom Jesus de Agua Fria, Pitauguý, and others.
44. I do not know.
45. All the cotton used by these factories is raised in this province.
46. Every little hut has a number of orange trees, while several species are found in the yards and gardens in villages and towns.
47. The growing of the plant from the seed is more certain, but when started from the branches they bear more quickly.
48. There is no fixed time, but the rainy season is preferable.
49. The orange has almost become indigenous in this country, and for this reason there is no special system of cultivation for it. It is a common thing to find in the forest gigantic specimens of this tree, the seeds having been carried there by birds or by some quadruped.

50. Dry land is the best for this plant. In such soil the tree does not grow so large, but the fruit is of a better flavor. I have noted that ferruginous soil causes the fruit to lose to a great extent its acidity. This is especially true of the orange, here called "tangerina," which is one of the best varieties, and almost entirely unknown in Rio de Janeiro.

51. The "herva de passarinho" will invariably kill the tree unless it is removed.

In the animal kingdom, however, the orange has enemies which are, perhaps, even more dangerous. A certain bee, known here by the name of "arapuá," destroys the tender shoots and renders the plant weak and sickly.

Having planted a lot of poppies as ornaments in my garden, I found that during the day thousands of these "arapuá" bees died about them. This I attributed to the narcotic principles of the flower. At all events, these destructive "arapuá" bees left my orange orchard, which is close to the garden.

The "sauva" ants are a genuine plague for the poor orange trees, and even the Capanema formicide is not able always to deliver us from the cohorts of these destroyers.

Other insects make their nests in the bark of the tree and do great damage.

A kind of a moth lays its eggs by hundreds on the leaves of the tree. In a few hours these hatch out larvæ, which devour the leaves just as those of the bombyx feed upon the leaves of the mulberry. An insect of the family of long horns during the warm nights opens a little hole near the trunk of the tree, buries itself about two palms below the surface, where it deposits eggs on the roots of the plant. The heat and moisture hatch out the larvæ, which gnaw at the roots, and in a short time the tree will die, unless something is done at once. The remedy is to stick shoots from the peach tree into these holes made in the roots by the insects. I believe that the prussic acid contained in the peach twigs poisons the larvæ. The result, however, is not always satisfactory, and the death of the tree is inevitable. It is the custom here to put animal manure about the trees, and if the planters would use lime as a fertilizer instead, perhaps this great inconvenience would be done away with.

52. I have made but few observations in regard to the direction of the winds. Since the end of last month, however, up to to-day it has blown steadily from the southeast.

53. In 1840 or 1842 locusts appeared in this municipality in such numbers that words cannot describe them. They did not leave a single leaf upon the campos or in the fields or gardens—they ate up everything—especially the grasses. Fortunately, since that time we have not had such importunate and dangerous guests.

From Felix Fernandes Portella.

REPLY No. 10.

BONITO, PROVINCE OF PERNAMBUCO, May 8, 1883.

1. Cotton was cultivated in this province previous to the invasion of the Dutch in 1630. As to the municipality of Bonito, the land was not under cultivation previous to the beginning of the present century. Since 1808 cotton has been planted with excellent results.

2. In the province of Pernambuco the places that yield most cotton are Pajeú de Flores, Buique, Cimbres Papacáça, Caruarú, Bonito, Brejo, and Limoeiro.

3. Pajeú, Buique, and Cimbres, which are more than fifty leagues from the sea coast.

4. "Crioulo" or Maranhão cotton, "quebradinho," and "herbaceo" are the kinds generally planted in this province.

5. With the first rains of the wet season, which is generally from January till March, and when the cotton is planted at any other season, the crop is always poor.

6. During the second and third years. After that the plants degenerate, and it is necessary to destroy them and plant anew.

7. The picking is continuous, beginning in October and lasting until the rains begin. The plants, however, generally have some open bolls on them all the year round.

8. Both kinds are used.

9. The seed is used for fuel where the gins are run by steam power, and also for fertilizer after it has been allowed to decay.

10. Plows are not used in this province, owing to their being expensive, and often useless. The hoe and bill-hook are used in cultivation.

11. Cotton is planted in rows to facilitate the passage of laborers, but this is not a general rule, for the land is not always suitable for it.

12. No, for the second growth is not good, and the plant would be destroyed.

13. See No. 12.

14. No such insect is known here.

15. Yes; in some years they attack and destroy the leaves of the cotton plants.

16. They appear generally in the first part of the winter after a few days of sunshine, but they disappear when the rains set in again.

17, 18. There is no certain time.

19, 20. The most favorable to them is the time between the rains; much rain or much sunshine destroys them.

21. They have no preference.

22. They have no preference.

23. It is not possible to specify, because the invasion of caterpillars is almost always local and often alternating.

24, 25. A fourth part of the crop. But if perchance the injury done by the caterpillars is confined to the leaves, and they do not attack the twigs also, even a larger crop may be expected. The reason of this is that when the leaves only are destroyed, they put forth a second time with more vigor.

26. Yes; they eat the blades of corn and of grass, the leaves of beans, and of various low, creeping plants.

27, 28. Nothing, for this plague of caterpillars comes from the state of the atmosphere. It is a freak of nature, and an evil without remedy.

29. Yes.

30-33. This disease attacks all kinds of cotton plants in all kinds of places, young as well as old, and decreases the yield considerably.

34. It is the general opinion among planters that cotton should be planted upon ground that has been freshly burned over, by which burning the strength of the "mofo" is destroyed. This "mofo" is a vegetable production of a parasitic nature, which moisture develops upon various objects, and, when it appears upon the trunks or stems of plants, living upon their sap it renders them diseased and incapable of producing their fruit. As regards the newly burned lands, it is my opinion that this modification is due to the presence of alkali or potash in the ashes. Experiments should therefore be made with lye, by washing the trunks of the plants with it, or even with lime water.

35, 36. Yes.

37. It is my opinion that this disease is caused by the electricity, which exercises great influence upon some plants, just as it does upon some animals. As to vegetation, it is well known that lightning causes the flowers of the cajú tree and of melons to fall, and makes the pinhas decay, and in the ponds and lakes it kills the small fish, while in the swamps it causes the crabs to go wandering about.

38. It is a disease without cure, for it is a freak of nature.

39. The "mofo" does the greatest damage.

40. The lack of roads for easy and cheap transportation, for when the price of cotton is low it does not pay for the labor of raising it.

41. The construction of roads for easy and cheap transportation, and the decreasing of the export duty on cotton, which should have been done long ago.

42. Ordinarily fifty kilos in seed produce fifteen kilos of clean cotton.

43. In Recife, the capital of this province, is, or used to be, one well-mounted cotton factory. In the interior of the province are several looms for weaving coarse cloth, and some tolerably good cloth.

44 and 45. Here the cotton is produced in the same province.

46. Yes.

47. The seeds are planted, and after they have sprouted and grown to about 2 feet in height these young plants are set out in orchards.

48. They are planted in the beginning of the wet season, and are watered and manured during the summer until they have reached about 3 meters in height.

49. See the preceding reply.

50. Only average. It has been observed that oranges prefer old worn-out land rather than new ground, for on the latter they are always sour and worthless.

51. Yes, the "enxerto" will even kill the trees if it is not removed down to the roots. Another great enemy of the orange trees is the "sauva" or "sauba" ants.

52. At Bonito and in its neighborhood the winds are from the southeast from October till March, while from April till July the winds are from the west, changing at times to northeast and north. Here the winds rarely come from the east, because they are shut out by the mountains. The strongest ones are those from the southeast, and these sometimes blow the corn down.

53. No; only a few times have locusts been known to appear here, and then only in passing from the west to the east. The few locusts found hereabouts in the trees do not belong to the class of migratory locusts.

From Manoel dos Santos Bezerros Leite, planter.

REPLY NO. 11.

BONITO, PROVINCE OF PERNAMBUCO, April 24, 1883.

1. No reply.

2. The most appropriate localities are in the dry section of the interior, both in respect to quantity and quality.

5. From December to February.

6. Two years and more, according to the strength of the soil.

7. There is but one picking during the year, which is during and after the month of September.

8. Iron saw-toothed gins are used.

9. The seed is used only to feed cattle.

10. Plows are not used.

11. It is not the custom to plant it in rows.

12. It is not the custom to prune the plants, but when it is done occasionally, it is done immediately after the cotton has been picked.

14. Nothing is known of a caterpillar boring the cotton bolls.

15. There are hosts of them that destroy the foliage.

16. They generally appear in April and May.

18. In April and May, till the rains begin.

19. When the sun shines steadily during April and May, but when the rainy season comes on they soon perish.

21. They attack young and old alike.

22. There does not seem to be any particular difference.

23. There is more or less destruction caused every year, with some exceptions.

26. The caterpillars eating the cotton don't seem to attack other plants.

27. The rain is the only remedy known.
28. Same as No. 27.
29. There is a disease of the cotton plant called "mofo."
30. This disease attacks all the plants.
31. More common on the old plants.
32. There is no exception in regard to locality.
33. There is no doubt but that this disease decreases the yield of cotton.
34. No remedy has been found.
35. "Queima," called by some "relampago," does considerable injury to cotton.
36. Locality makes no difference, so far as I know.
37. The "queima" stops the growth of the bolls and makes them dry up.
38. No remedy is known.
39. These evils are all equally prejudicial.
40. The most serious drawback to cotton culture is, in my opinion, the lack of the necessary railways running into these cotton-growing regions.
41. Building of these railways would animate this industry.
43. I know of no factories in this province.
46. There are a great many large plantations of oranges in this province.
47. The seed are planted in beds, and after one or two years the sets are transplanted.
48. As they grow stronger some of the branches are pruned off.
49. Nothing more than to plant them 13 or 14 fathoms apart.
50. Dry ground, and especially that under cultivation.
51. That called "euxerto de passarinho" does great injury to these plants, and finally destroys them unless it is cleared off every year.

From Dr. João Francisco Dias Cabral.

REPLY NO. 12.

MACEIO, PROVINCE OF ALAGÔAS, *May 8, 1883.*

JOHN C. BRANNER,

DEAR SIR: In replying to the circular you honored me with, I am sorry not to be able to answer all your questions. I send herewith, however, what information I am able to furnish to aid you in the fulfillment of your commission.

1. Cotton was introduced in this province between 1779 and 1798, when Judge José de Mendonça e Mattos Moreira, who was *ouvidor*, urged the advantages of this plant.

2. The comarcas of Imperatriz and Palmeira, and the valleys of the Parahyba and São Francisco Rivers.

4. Two kinds of "herbaceous" cotton, one a dwarf variety which yields but one crop, another growing taller and lasting for four years. Another quality, called "quebradinho," is tree-like, and produces good cotton for many years. There is also a very small amount of colored cotton raised along the São Francisco River.

7. When the cotton is planted in January and February the picking takes place in December; but when the planting is done in March or April the picking is in February of the following year. There are eight months between the planting and the picking, and there is but the one crop during the year.

8. Both the iron and wooden gins are used.

9. The seed is used for fuel.

16. The caterpillars appear in April and May, but they are immediately killed by the heavy rains in June.

20. Dry weather favors the appearance of the caterpillar.

29. The "mofo" is rare in this province. It appears in the beginning of summer—in October—and almost always on the old stalks.

35. The drying of the bolls, called "queima," is caused by the lightning and always takes place in August. It causes the bolls to fall, especially when there are alternate rains and sunshine.

39. The caterpillars.

42. With "quebradinho" cotton $3\frac{1}{2}$ kilos produce 1 of clean cotton; with the herbaceous variety, $2\frac{1}{2}$ kilos yield 1 kilo of clean cotton.

43. There is one at Fernão Velho, a suburb of Maceio. It was founded in 1863, and belongs to a company called the "União Mercantil." The capital of the company is 300,000 milreis. The factory employs one hundred and four persons, of whom ninety-two are operatives. In 1880-'81 this factory wove 496,375 meters of cloth (sacking), valued at 86,865 milreis.

45. It comes from the vicinity and from the interior.

52. From January till March, months of great heat, the wind is from the northeast; from April to June it is from the south.

From Thomas José d'Aquino Pereira, planter.

REPLY NO. 13.

ENGENHO JARDIM,

Bonito, Province of Pernambuco, June 6, 1883.

DEAR SIR: * * * In view of the fact that during the time that I cultivated cotton I did not observe and study it systematically, I fear my answers will not be entirely satisfactory. But my desire to do all in my power to encourage this branch of agriculture in my province makes me bold to send you the following answers.

Placing my services at your disposal, I am, your friend and servant,

THOMAS JOSÉ D'AQUINO PEREIRA.

JOHN C. BRANNER.

2. Bonito, Panellas, Brejo, Pesqueira, Buique, Limoeiro, Taquaretinga, and the comarcas of Pajehú.

3. The best qualities are from Bonito, Panellas, Brejo, and Pajehú.

4. There are several qualities, known generally by the following names: Crioulo, quebradinho, macaco, albaço of three kinds, the best of which is that having a green seed.

5. In the comarcas of Bezerros, Limoeiro, Caruarú, São Bento, Buique and those farther inland, cotton is planted from January till February. To the south it is planted in February and on till April, when the rains set in.

6. It bears from three to four years in some of the localities of the interior.

7. There is but one crop per annum. In the interior it is picked from September till December, and to the south from November till February.

8. Saw gins are used, driven by steam, water, or animal power, and also some small machines run by hand.

9. In some places the seed is used for fuel, in others to feed the cattle, and in others it is thrown away.

10. Plows are not used.

11. Cotton is planted in rows seven or eight palms apart in one direction, and four or five apart in the other direction. Between these rows corn and beans are often planted. This, however, is not good for the cotton.

12. The plants are not pruned. In mountainous land, however, after the cotton is picked, the plants are broken off in the middle, and when it rains the new leaves and branches come out. In the interior it is the custom to turn cattle into the fields and their breaking of the plants produces the same effect.

13. Answered.

14. There is no caterpillar that bores the cotton bolls, but in the interior the crooked-billed birds do great injury by eating the young tender bolls.

15. There are caterpillars that eat the leaves and even the tender branches of the plants.

16. They make their appearance in April and May, and in the interior even as early as March, and should there be a second appearance of them the plants are so injured that they yield but little.

17. April and May are the months in which they do their greatest injury.

18. This plague lasts from twenty to thirty days.

19. Whenever the rains stop for a short time and are followed by a week of sunshine.

20. The dry weather is more favorable to them.

21. They attack the older plants because the older the plants the larger the leaves on them.

22. There is no difference in regard to locality.

23. I cannot give the years exactly, but whenever there is a prolonged drought these caterpillars do their greatest harm, especially if the winter begins early—in December or January.

24. Where they are developed in numbers, about one-third of the whole crop.

25. One-third part of the crop.

26. The caterpillar that eats the cotton does not eat any other plant.

27. Cotton-planters have done nothing to rid themselves of these caterpillars, for their coming depends upon the condition of the atmosphere.

28. No.

29. Yes.

30. This "mofo," or mildew, does not attack all the plants alike.

31. It is more common on plants two or three years old.

32. It appears on high and low ground or on wet and dry alike. It comes from lands on which horses have been pastured, and which have not been well burned over before planting.

33. It is the general opinion that it is very injurious to the plants, for those attacked do not last long.

34. No remedy has yet been discovered.

35. "Queima" appears some years.

36. It is the same in all kinds of localities.

37. It generally appears with a change in the weather, especially when there are rains accompanied by winds and thunder, just at the time when the bolls are beginning to open. The boll then dries up and the cotton rots within it.

38. None so far.

39. The queima is most prejudicial when it occurs.

40. In the interior it is generally a lack of sufficient rain, and a lack of labor as well.

41. The *Banco Agricola* or colonists. This in view of the fact that slavery is almost extinct, and that the people here do not take to work, and will not unless some energetic measures are adopted by the Government.

42. This depends on the quality of cotton. With the "quebradinho" three kilos in seed yield one clean.

43. There is one factory in the suburbs of the city of Pernambuco, but it is so little known that we, through this part of the country, still use cloth from Bahia and Rio de Janeiro for sacking our sugar.

44. Raised in this province.

45. Many oranges are planted, and even in the interior in well-watered places.

46. The seeds are planted in beds, and afterwards the young trees are transplanted. Another method is to graft these young trees. In this last-mentioned way they bear fruit sooner.

48. They are planted during the winter and kept well cleaned.
49. Nothing more than keeping off the parasitic plants and the saúba ants.
50. Moist ground is better.
51. Very much. They always put the tree back, and unless removed will finally kill it.
52. In the interior they vary much. Here they come mostly from the south, except during showers, when they are often from the north.
53. They have in years past done great injury in the interior by devouring various plants, among them corn and beans.

From Jonas Fernandes d'Araujo Santos.

REPLY NO. 14.

BONITO, PROVINCE OF PERNAMBUCO, *June 8, 1883.*

2. Brejo da Madre de Deos, Buique, Pesqueira, Limoeiro, Taquaretinga, Pajeú, Bonito, Panellas, and the high lands of the interior.
3. Bonito, Panellas, Brejo, Pajeú, and the table lands.
4. The names by which they are known here are "crioulo," "quebradinho," "macaco," "herbaceo." Of this last there are three varieties, the best of which is known as "verdão."
5. In those sections of the country known as "caatinga" cotton is planted in January and February. Nearer to the coast it is planted in February and from that time until April.
6. Here in Bonito it yields well for only two years.
7. There is but one crop a year. In the interior it is gathered from September till December, while nearer the coast it is gathered from November till February.
8. The saw-toothed gins are used.
9. Both here and in the interior it is only used for fuel for the steam-motors and to feed cattle.
10. Plows are not used.
11. Cotton is planted in hills six or seven palms apart.
12. It is not pruned.
14. There is no caterpillar that bores the boll.
15. There are caterpillars that eat not only the leaves, but even the tender shoots.
16. They make their appearance here from April till May, earlier or later, according to the rains; in the interior they make their appearance earlier.
17. They do their greatest damage in April and May.
18. They last twenty or thirty days.
19. When the first rains of winter are followed by eight or ten days of sunshine.
20. Dry weather, for when the regular rains set in they soon disappear.
21. They attack the older plants by preference.
22. They show no preference.
23. I don't know.
24. When they appear here they destroy more than a third of the crop. However, they do not always appear in all places at the same time. They may appear here and not in the interior, and vice versa.
25. Over one-third part.
26. The caterpillar that eats cotton does not eat any other kind of a plant.
27. The planters have done nothing to rid themselves of this pest.
28. No remedy is known.
29. The disease called "mofo" or mildew exists.
30. It is more common on the old plants, but does not attack all plants alike.
31. The older ones.

32. It shows no preference in regard to land.
33. It is the general opinion that the plants attacked by this disease not only yield less, but that they have less vitality.
34. No remedy is known.
35. We have the "queima" some years, which causes the bolls to fall, or impedes their growth and opening.
36. It is the same on all kinds of ground.
37. It is due to lightning accompanying the rains that fall just when the bolls are about opening.
38. No remedy is known.
39. In those years when it makes its appearance the "queima" is worst.
40. There is a difference of opinion upon this subject. It is mine, however, that the greatest drawback is the lack of theoretical and practical knowledge of agriculture.
41. The existence of associations that will lend money to the planters at a low rate of interest, and good highways.
42. Of herbaceo forty-two kilos, and fifty-two of other kinds yield fifteen kilos of clean cotton.
43. There is one in the city of Pernambuco.
45. Raised in this province.
46. A great many orange trees are planted here.
47. The preferred method and the one by which fruit is obtained soonest is by grafting.
48. This graft is prepared in the summer time by the following method: The bark is removed from the branch of an orange tree for about 4 inches. Above this a lot of earth is secured in some way about the branch. This is then watered every day until the winter rains come on. Then this branch is cut off at the place where the bark was removed and is planted permanently. Young plants are also obtained by planting the seed.
49. Nothing more than keeping the ground clean about them.
50. Dry land is better—not too dry, though.
51. If these parasites are not removed they not only prevent the tree's producing, but finally kill it.
53. I have only heard of their destruction in the interior.

From José Joaquim da Cunha.

REPLY No. 15.

BONITO, PROVINCE OF PERNAMBUCO, *May 27, 1883.*

2. Pajehú de Flores and Bom Jardim.
3. The best qualities are from Bonito, Brejo da Madre de Deos, Caruarú.
4. Crioulo, quebradinho, verdão, albaço, carrapicho, Maranhão and macaco.
5. February and March.
6. The plants yield good cotton for two years.
7. There are two pickings a year, in January and February.
8. Saw-toothed gins.
9. Food for cattle.
10. Plows are not used.
11. Planted in hills.
12. No.
14. There are no caterpillars, but there are birds that destroy the bolls.
15. Great damage is done by caterpillars eating the leaves of the cotton plants.
16. They appear in May.
17. Their greatest harm is done in May.
18. The plague lasts as long as the cotton leaves do.

19. In the summer.
20. Dry weather is most favorable to their development.
21. They attack both alike.
22. No difference is noticed.
23. Their greatest damage was in 1882.
26. The same caterpillar does not destroy other plants.
27. Nothing.
28. No.
29. Yes.
30. The "mofo" attacks only a part of the plants.
31. No preference.
32. In all alike.
33. It is the opinion that it makes no difference in the yield.
34. No remedy is known.
35. Yes.
36. The same in all places.
37. Cannot explain it.
38. No remedy is known.
39. The "queima."
40. The "queima."
42. Forty-five kilos of "alvão." The other qualities yield less.
43. There is a factory in the House of Charity of the city of Bezerros.
45. What is used in this factory is grown in the neighborhood.
46. Many orange trees are planted here.
47. The seed are sprouted in beds until the plants are large enough to be transplanted.
48. These young trees are set out during the most rainy season of the year, and they are then treated like other plants.
49. There is no cultivation proper.
50. Dry ground is better.
51. These parasites do great injury to the trees when they are not removed.
53. We have not been troubled with locusts in this province.

From Antonio José Pereira.

REPLY No. 16.

BONITO, PROVINCE OF PERNAMBUCO, May 19, 1883.

1. Since the invasion of the Dutch.
2. Buíque, Pesqueira, Pajeú, Brejo, Bonito, Bom Jardim, and Pedra.
3. Pajeú, Pedra, and Brejo.
4. Several; "quebradinho" is preferred.
5. In the month of February.
6. Two years on an average.
7. One crop a year, picked in December and January.
8. Saw-toothed gins.
9. Seed used as food for cattle.
10. No. Everybody uses the hoe.
11. Yes.
12. Yes.
13. During the picking, breaking off the branches with the hands.
14. No.
15. Yes.
16. In May.

17. May and June.
18. Two weeks on an average.
19. Dry weather.
20. The dry weather.
21. They attack both alike.
22. They make no difference.
23. Not known.
24. Fifty per cent. on an average.
25. Not known.
26. They do not.
27. Nothing.
28. No.
29. Yes.
30. At least a third of them.
31. In the second year.
32. There is no noticeable difference.
33. Yes.
34. No.
35. Yes.
36. Yes.
37. It is generally caused by the lightning and the rains that fall about midday.
38. None is known.
39. They are all alike prejudicial.
40. The evils referred to and the difficulty of transportation to market.
41. Facility of transportation, prices to correspond to the labor spent on the material, and plenty of hands.
42. Sixty kilos.
43. There is one.
45. From this province.
46. Yes.
47. From the seed.
48. See 47.
49. Removing the parasitic plants.
50. Dry ground.
51. Yes; they kill the trees.
52. East, west, south. and north.
53. No.

From R. Cleary, A. M., M. D.

REPLY NO. 17.

LAGES, PROVINCE OF SANTA CATHERINA, *June 16, 1883.*

DEAR SIR: Your circular of April 10 last, with regard to cotton diseases and insects, was duly received, and I beg leave to reply that in this part of the province, that is, west of the Serra do Trumbudo, and on the headwaters of the Uruguay, cotton is not planted, as the climate is too cold and too subject to frosts. I have written to a competent person on the coast for information, and will forward it when received. I may say now, however, that cotton is only planted in small quantities and for home consumption in this province, and its cultivation is in the most rudimentary style, amongst a people who despise and refrain from the use of the plow.

Very respectfully, your obedient servant,

R. CLEARY, A. M., M. D.

JOHN C. BRANNER, Esq.,
Washington, D. C.

From Candido José Gonçalves Malveira.

REPLY NO. 18.

LIMOEIRO, PROVINCE OF CEARÁ, May 22, 1883.

1. In this municipality, since 1870, the "erbaceo," and "crioulo" more recently.
2. Limoeiro, Russas, Catinga de Góes, Acarape, Pereiro, and Icó.
3. Limoeiro, Russas, Catinga de Góes, and Pereiro.
4. "Erbaceo," "crioulo," and "quebradinho."
5. In the highlands it is planted from January to April, and on the low ground till June.
6. Two years.
7. Three crops. On the high grounds the picking is from August to November, and on the low lands from September till December.
8. Both kinds.
9. Food for cattle.
10. No.
11. Yes.
12. No.
14. Yes. They appear during and after June.
15. Yes.
16. In February and March.
17. In these same months.
18. No certain time.
19. When they appear during the dry weather they are destroyed by the rains, and when they are brought on by the rains, they disappear when the rains cease.
20. Dry weather.
21. They prefer the old ones.
22. They have no preference.
23. Their destruction is caused every year.
24. Ten per cent.
25. About the same every year, i. e., ten per cent.
26. They eat also corn and beans.
27. Nothing.
28. No.
29. Yes.
30. On some plantations they attack all the plants, while on others they attack only some of them.
31. On those of the second year.
32. Without distinction.
33. Yes.
34. No.
35. Yes.
36. Without distinction.
37. The leaves of the plants are attacked by a great number of soft, whitish mosquitos, which subsist upon them, leaving them with a burnt appearance.
38. None. It generally disappears when the rains become regular.
39. The "queima."
40. The lack of industry, of laborers, and of plows, and the irregularity of the winters.
41. If it were possible, the disappearance of the above-mentioned obstacles.
42. Fifty-two.
43. There are none.
46. Oranges are planted in various parts of this province, but not in this municipality.
52. From January till June the winds are from the south, and during the other months of the year they are from the east.
53. Not in this municipality.

DIRECTION OF THE WINDS AT PALMARES, PROVINCE OF PERNAMBUCO, BRAZIL, 1877 TO 1882, INCLUSIVE.

[An extract from the official Meteorological Observations of the Prolongation of the Recife ao São Francisco Railway, made at the Palmares office, under the direction of the engineers. Palmares, or Una, is 142 kilometers from the city of Pernambuco, and about 70 kilometers from the coast. Three observations were made each day. The month is divided into "decades," and the sum of the observations gives the result.]

Months.	1877.								1878.							
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
January	1	3	11	28	0	0	0	1	1	8	15	21	4	0	1	0
February	0	3	11	25	2	0	0	0	0	4	13	16	1	0	0	0
March	0	6	7	22	6	4	1	1	0	7	15	20	2	0	0	0
April	1	3	2	15	3	2	0	1	1	6	12	25	7	1	0	0
May	0	4	1	18	4	2	1	1	0	0	7	17	10	3	2	1
June	0	2	4	22	6	0	2	1	0	0	7	13	7	3	1	0
July	1	2	4	20	10	2	0	1	0	0	6	21	12	1	0	0
August	0	3	11	12	7	0	2	1	0	1	7	19	11	1	0	0
September	0	13	10	14	5	1	0	0	0	2	18	12	7	1	0	0
October	0	24	31	8	0	1	0	0	0	8	17	22	0	0	0	0
November	2	17	12	16	1	0	0	0	4	8	17	21	1	0	0	0
December	2	17	16	13	0	0	0	0	3	13	20	8	0	0	1	2
Total	7	97	120	213	44	12	6	7	9	57	144	215	62	10	5	3

Months.	1879.								1880.							
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
January	5	17	25	4	1	0	0	1	1	10	30	6	2	0	0	0
February	6	16	21	2	0	0	0	1	0	5	27	3	2	2	1	0
March	5	14	25	7	4	0	0	0	1	5	28	3	4	2	0	0
April	0	23	21	8	4	0	0	2	4	4	28	2	4	2	0	0
May	1	18	15	16	3	0	0	1	0	3	30	11	5	1	0	0
June	0	12	19	12	9	0	0	0	1	2	27	9	4	1	0	1
July	0	7	25	17	12	0	0	0	1	0	31	3	9	0	0	0
August	0	13	17	19	7	2	0	0	2	0	31	7	17	2	1	0
September	0	23	20	5	4	0	0	0	3	0	27	14	10	0	0	0
October	0	11	28	7	1	0	0	0	18	0	20	13	15	3	2	0
November	1	12	28	2	2	1	0	1	24	0	17	15	11	1	0	0
December	0	11	31	4	1	0	0	1	15	0	20	19	7	4	0	0
Total	18	177	275	103	48	3	0	7	70	29	316	105	90	18	4	1

Months.	1881.								1882.							
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
January	8	0	30	12	5	2	0	1	18	2	19	15	5	3	0	2
February	7	0	25	13	8	2	0	0	20	5	9	11	17	1	0	0
March	12	0	25	13	9	0	0	1	3	1	23	20	16	2	0	0
April	5	0	25	19	11	2	3	0	2	0	22	18	10	1	0	0
May	3	0	27	18	12	3	0	1	0	0	24	26	12	4	0	0
June	7	0	22	15	7	3	9	2	0	0	20	22	17	3	0	0
July	6	0	24	21	7	3	3	1	1	0	14	30	18	2	1	0
August	9	0	25	15	4	6	4	2	0	0	17	27	22	0	0	0
September	10	1	21	17	4	8	1	0	3	5	19	28	9	1	0	0
October	21	0	17	11	6	2	0	1	10	16	20	28	2	0	0	0
November	19	5	16	13	5	1	0	1	2	10	16	26	9	0	0	0
December	17	1	14	19	7	0	1	0	0	4	20	29	9	1	0	0
Total	124	7	271	186	85	31	21	10	59	43	223	280	146	18	1	2

RECAPITULATION.

Years.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
1877.....	7	97	120	213	44	12	6	7
1878.....	9	57	144	215	62	10	5	3
1879.....	18	177	275	103	48	3	0	7
1880.....	70	29	316	105	90	18	4	1
1881.....	124	7	271	186	85	31	21	10
1882.....	59	43	223	280	146	18	1	2
Total	287	410	1,349	1,102	475	92	37	30

